PRIVATE
DEPOSITORY

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

Vol. LIII. No. 3. January 1893.

Fellows of the Society are informed that post-cards containing the titles of papers to be read at the evening meetings will be sent to those who shall express their wish to receive them. Fellows desiring to receive the post-cards are requested to send their names to the Assistant-Secretary, Mr. W. H. Wesley, Burlington House, London, W.

In order to enable the Secretaries to prepare complete lists in time for the issue of the post-cards, authors are particularly requested to send in their papers not later than the Tuesday preceding the day of meeting.

Fellows are informed that Vol. L. of the *Memoirs* is now published, and may be had on application at the apartments of the Society; or will be sent post free on receipt of a written request to that effect, addressed to the Assistant-Secretary.

The price of Vol. L. to the public is 12*s.* 6*d.*

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. LIII. JANUARY 13, 1893. No. 3

E. B. KNOBEL, Esq., President, in the Chair.

Joseph Ibbitson Berry, 20 Alwyne Road, Canonbury, N.;
Martin Brendel, Ph.D., Privat-Docent at the University, Greifswald, Germany;
Ernest Gould Dixon, 4 The Lawn, Balham Park Road, S.W.;
Harold Dennis Taylor, 20 Bootham Terrace, York,

were balloted for and duly elected Fellows of the Society.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers from personal knowledge being appended:—

Maurice Anderson Ainslie, B.A., Giggleswick School, Settle, Yorkshire (proposed by W. H. M. Christie);
James Arthur Formoy, F.C.S., Lestelle, London Road, Forest Hill, S.E. (proposed by Raphael Meldola);
Henry Bateman Massey, Engineer, &c., Spalding (proposed by George Calver);
John Mills, Editor of *Science and Art*, 11 Henrietta Street, Covent Garden, W.C., and 44 Orbel Street, Battersea Park, S.W. (proposed by A. Fowler);
Edward Turner Whitelow, Civil Engineer, 70 Deansgate, Manchester (proposed by Arthur Mee).

Seventy-six presents were announced as having been received since the last meeting, including, amongst others—

Arthur Cayley, Collected Mathematical Papers, vol. v., presented by the author; Sir R. S. Ball, Atlas of Astronomy,

presented by the publishers; Berlin Observatory, Zonenbeobachtungen 20° bis 25°, presented by the Observatory; Padua University, Papers relating to the Galileo Tercentenary, presented by the University; *Nautical Almanac* for 1896, and ditto, part i., presented by the Admiralty; Fifteen lantern slides of solar prominences, faculæ, &c., taken at the Kenwood Observatory, Chicago, presented by Professor G. E. Hale; Seven lantern slides of lunar eclipse, 1892, May 11, presented by Mr. Newbegin.

Opposition of Mars, 1892. *Observations made at the Royal Observatory, Cape of Good Hope.* By David Gill, LL.D., F.R.S., H.M. Astronomer.

When Professor Eastman's programme reached the Cape I removed the declination micrometer frame of the transit circle, and with the apparatus which is attached for this purpose to our Repsold photograph-measuring micrometer ruled a pair of lines upon it and inserted a new pair of webs, 16″ apart, parallel to the old declination web.

Subjoined are the data relative to the distance and inclination of the wires thus inserted.

The distance between the wires at the middle wire was found to be 16″·03.

The inclination was determined as follows:—

1. The transit circle pointing north was placed horizontal, and the north collimator was rotated about its optical axis till the horizontal web of the collimator became parallel to that of the transit circle.

2. The south collimator was directed upon the north collimator, and its horizontal wire adjusted to parallelism with that of the north collimator.

3. The transit circle was then directed to the south collimator, and the inclination of its horizontal wire with respect to the corresponding collimator wire was measured. It is clear that half the apparent inclination of the horizontal web of the transit circle to that of the south collimator will then be the true inclination of the transit-circle web.

The process is an exceedingly accurate one, independent determinations on June 23, 27, 29, and 30 giving practically identical results.

For the new wires (named Y and Z) the mean corrections were:—

At point of intersection by the vertical webs

	Middle Wire.					
	α	β	ι	γ	γ	δ
	″	″	″	″	″	″
Y	−0·06	−0·01	+0·02	+0·02	−0·04	+0·06
Z	−0·02	+0·01	−0·02	+0·03	−0·01	+0·05

These are the actual means of observations, which should, of course, be smoothed to quantities proportional to the distance, if rigorous corrections were required for inclination. But the method of observation has been so arranged that the effect of inclination of the wires is entirely eliminated. In observing stars, the image was first bisected near wire α with wire Y and near wire 1 with Z; the reversing prism was then rotated 90° on its axis and the star again bisected with Z near wire 7 and with Y near wire δ; or Z might be used first to bisect near wire α, in which case it was also used to bisect near wire δ, while Y was used at wires 1 and 7. Thus, in every case, the prism was reversed between the observations at wires 1 and 7, and the star was bisected by both wires in each position of the prism.

The interval from α to 1, 1 to 7, 7 to δ is about twenty-six seconds, allowing ample time to read the declination micrometer.

In observing the image of *Mars*, the pointings up to August 4 (inclusive) were made in the manner requested by Professor Eastman by two similar pointings at α and 1, the prism then being rotated 90° (*i.e.* a visual rotation of the image of 180°) and two further similar pointings made at 7 and δ. From August 5 to September 21 the prism was rotated 90° in the same direction after each pointing, so that the image was presented to the observer under every possible variety of reversion. Corrections for refraction and curvature of the path, as well as those for division-error, screw-error, and runs, have been rigorously applied, but the corrections for parallax of the planet, and for reduction to the mean places of the stars, have been omitted, as they must in any case be recomputed on a rigorous and uniform basis by anyone who undertakes a discussion of the observations.

The zenith distances have been referred to the nadir.

The initials of the observers P. and C. are those of Messrs. R. T. Pett and W. H. Cox.

Royal Observatory, Cape of Good Hope:
1892 *December* 10.

Observations of Mars and Comparison Stars made at the Royal Observatory, Cape of Good Hope, 1892.

Date. 1892.	Obs.	*O. Arg. S.* 20970.	*η Capricorni.*	*27 Capricorni.*	*φ Capricorni.*	*Mars.*	*Lacaille* 8851.	*41 Capricorni.*	*D. M.*−20 6293.	*Lalande* 42700.
		112° 25′	110° 16′	110° 59′	111° 5′		113° 55′	113° 44′	110° 4′	111° 38′
June 28	P	...	48″·98	17″·34	52″·40	110° 21′ 21″·66	56″·44	55″·86	30″·27	51″·97
30	P	...	48″·11	17″·29	52″·28	110° 27′ 20″·59	56″·46	55″·86	29″·88	51″·79
July 1	C	4″·25	49″·21	17″·54	53″·13	110° 30′ 39″·93	56″·65	55″·59	29″·63	51″·75
6	P	3″·29	47″·61	16″·19	50″·99	110° 50′ 28″·00	54″·82	54″·15	28″·04	50″·37
7	C	3″·21	47″·89	16″·38	51″·68	110° 55′ 3″·00	56″·12	55″·24	28″·83	50″·58
8	P	3″·78	48″·30	17″·51	52″·12	110° 59′ 49″·98	56″·15	55″·40	29″·37	51″·21
11	C	5″·30	49″·06	17″·05	52″·80	111° 15′ 14″·54	55″·81	55″·14	29″·19	50″·68
19	C	3″·34	48″·05	16″·85	51″·78	112° 2′ 50″·02	55″·61	54″·74	28″·48	50″·72
20	P	3″·06	47″·22	15″·70	50″·73	112° 9′ 13″·39	54″·79	54″·20	27″·51	50″·04
22	P	2″·98	47″·89	16″·49	51″·94	112° 22′ 11″·12	55″·50	54″·95	28″·47	50″·36
26	P	2″·90	47″·27	15″·69	50″·84	112° 48′ 5″·98	54″·61	53″·82	27″·48	49″·59

Date. 1892.	Obs.	*Lacaille* 8463.	*Lacaille* 8506.	*17 Capricorni.*	*Lacaille* 8612.	*Mars.*	*Lacaille* 8813.	*Lacaille* 8832.	*Lacaille* 8851.	*O. Arg. S.* 21562.
		112° 44′	114° 36′	111° 54′	114° 11′		114° 17′	115° 39′	113° 55′	112° 24′
July 27	C	53″·07	10″·55	...	8″·71	112° 54′ 29″·20	...	...	...	...
28	P	52″·74	11″·55	16″·67	9″·03	113° 0′ 47″·79	4″·62	46″·75	53″·85	57″·36
30	P	52″·80	11″·09	16″·72	9″·42	113° 13′ 6″·69	4″·77	47″·28	55″·23	57″·26
Aug. 1	P	53″·33	11″·50	16″·97	8″·75	113° 24′ 52″·57	4″·41	46″·84	54″·89	56″·81
2	C	52″·77	11″·36	16″·94	9″·21	113° 30′ 31″·52	4″·62	47″·53	55″·35	57″·13
3	P	51″·82	10″·39	16″·58	9″·42	113° 35′ 59″·97	3″·96	46″·72	54″·23	58″·03
4	C	53″·18	12″·00	17″·59	9″·55	113° 41′ 15″·60	4″·99	47″·28	55″·62	57″·29
5	P	52″·48	11″·13	16″·91	9″·01	113° 46′ 18″·79	4″·93	47″·27	55″·07	57″·49
6	C	52″·27	11″·34	16″·39	...	113° 51′ 8″·71	...	...	...	...
10	C	53″·75	13″·31	18″·58	10″·06	114° 8′ 0″·88	5″·48	47″·93	55″·74	57″·59

Date. 1892.	Obs.	*O. Arg. S.* 20429.	*Lacaille* 8463.	*Lacaille* 8506.	17 *Capricorni.*	*Mars.*	*Lacaille* 8734.	*Lalande* 41404.	ζ *Capricorni.*	37 *Capricorni.*
		113° 49′	112° 44′	114° 36′	111° 54′		115° 17′	112° 50′	112° 52′	110° 33′
Aug. 11	P	...	52″·54	11″·17	16″·59	114° 11′ 32″·51	13″·33	28″·51	35″·29	46″·65
12	C	2″·07	53″·65	11″·69	17″·02	114° 14′ 47″·23	13″·26	28″·49	35″·50	46″·94
16	C	...	53″·11	...	17″·10	114° 24′ 48″·95	13″·05	28″·31	35″·30	45″·66
18	C	1″·95	53″·79	12″·08	17″·08	114° 27′ 57″·72	11″43	...	...	...
19	P	1″·25	52″·38	11″·47	16″·66	114° 29′ 3″·17	13″·92	28″·92	35″·53	47″·20
20	C	1″·97	53″·12	12″·32	17″·84	114° 29′ 51″·35	13″·20	28″·34	33″·93	45″·85
22	C	2″·28	53″·69	12″·39	17″·48	114° 30′ 25″·31	13″·38	...	...	...
24	C	2″·62	54″·25	11″·87	17″·70	114° 29′ 43″·50	13″·69	28″·81	36″·20	46″·83
26	C	...	53″·66	...	17·″87	114° 27′ 44″·93	...	...	34″·91	...
29	P	2″·43	53″·97	12″·56	...	114° 22′ 27″·99	13″·82	29″·27	35″·92	46″·41
30	C	...	53″·38	...	17″·63	114° 20′ 6″·35	14″·00	29″·57	36″·20	47″·23
Sept. 1	C	1″·60	54″·10	12″·22	17″·42	114° 14′ 31″ 42	14″·47	28″·47	35″·35	46″·43
2	P	2″·84	53″·87	12″·72	17″·81	114° 11′ 18″·07	13″·69	28″·77	35″·92	46″·58
3	C	3″·32	54″·47	13″·19	18″·13	114° 7′ 48″·58	14″·62	29″·34	35″·85	47″·05
6	P	3″·16	54″·25	13″·39	17″·94	113° 55′ 45″·26	14″·73	29″·62	36″·73	47″·36
7	C	2″·61	54″·69	12″·99	18″·61	113° 51′ 14″·02	15″·09	30″·13	36″·16	47″·78
8	P	2″ 87	54″·96	13″·49	18″·30	113° 46′ 27″·57	...	...	...	...
12	P	3″·46	54″·72	13″·24	18″·46	113° 25′ 3″·43	15″·00	29″·92	16″·74	47″·76
13	C	3″·43	54″·75	13″·58	18″·76	113° 19′ 8″·98	15″·23	30″·07	36″·66	47″·77
14	P	3″·43	54″·67	13″·04	19″·07	113° 13′ 2″·09	...	...	36″·58	47″·00
15	C	...	54″·65	13″·55	18″·42	113° 6′ 41″·20	14″·74	30″·09	36″·96	47″·59
17	C	3″·82	55″·11	14″·15	18″·72	112° 53′ 24″·13	15″·39	30″·48	36″·73	...
19	C	3″·77	55″·19	13″·72	18″·92	112° 39′ 18″·81	14″·93	30″·90	37″·26	48″·17
20	P	4″·18	54″·99	13″·99	18″·82	112° 31′ 58″·48	15″·30	30″·73	36″·76	48″·15
21	C	4″·16	55″·51	14″·65	19″·27	112° 24′ 26″·85	16″·04	30″·78	37″·40	48″·76

On the Determination of the Equations for the Perturbation of the Inclination and Node of an Orbit by the Method of Variation of Constants. By Robert Bryant, D.Sc., B.A.

The method adopted by Oppolzer and by Watson for determining the differential equations for the change in the position of the plane of the orbit seems to me less simple than the following.

Taking the sun's centre as origin, let three rectangular axes be chosen, whose positions will be more closely specified hereafter.

Let

x, y, z be the coordinates of the disturbed planet,

and

x', y', z' „ „ disturbing „

Then k being the Gaussian constant and p the semi-parameter of the orbit, we have

$$k\sqrt{p(1+m)}\cos i = xv_y - yv_x$$
$$k\sqrt{p(1+m)}\sin \Omega \sin i = yv_z - zv_y$$
$$-k\sqrt{p(1+m)}\cos \Omega \sin i = zv_x - xv_z$$

where v_x, v_y, v_z, are the velocities of the disturbed planet parallel to the coordinate axes.

By the differentiation of these equations and the introduction of suitable modifications we obtain the required results.

Now the quantities on the right-hand sides of the above equations are subject to two distinct kinds of variation: one arising from a change in the time only, such as occurs in the case of undisturbed motion; the other, that arising from the perturbation. Denote the former of these by the symbol $\frac{d_1}{dt}$, and the latter by $\frac{d_2}{dt}$, and let $\frac{d}{dt}$ denote the total variation, so that

$$\frac{d}{dt} = \frac{d_1}{dt} + \frac{d_2}{dt}.$$

Then putting for brevity

$$P = k\sqrt{p(1+m)},$$

we have

$$\frac{dP}{dt}\cos i - P\sin i\frac{di}{dt} = \frac{dx}{dt}v_y + x\frac{dv_y}{dt} - \frac{dy}{dt}v_x - y\frac{dv_x}{dt}.$$

$$\frac{dP}{dt}\sin \Omega \sin i + P\cos \Omega \sin i\frac{d\Omega}{dt} + P\sin \Omega \cos i\frac{di}{dt} = \frac{dy}{dt}v_z + y\frac{dv_z}{dt} - \frac{dz}{dt}v_y - z\frac{dv_y}{dt}.$$

$$\frac{dP}{dt}\cos \Omega \sin i - P\sin \Omega \sin i\frac{d\Omega}{dt} + P\cos \Omega \cos i\frac{di}{dt} = \frac{dz}{dt}v_x + z\frac{dv_x}{dt} - \frac{dx}{dt}v_z - x\frac{dv_z}{dt}.$$

The total differentials

$$\frac{dx}{dt'}\ \frac{dy}{dt'}\ \frac{dz}{dt}$$

are the velocities parallel to the coordinate axes.

Also

$$x\frac{dv_y}{dt}-y\frac{dv_x}{dt}=x\left(\frac{d_1v_y}{dt}+\frac{d_2y}{dt}\right)-y\left(\frac{d_1v_x}{dt}+\frac{d_2v_x}{dt}\right)$$

$$=x\frac{d_1v_y}{dt}-y\frac{d_1v_x}{dt}+x\frac{d_2v_y}{dt}-y\frac{d_2v_x}{dt}.$$

Now at any instant the body is supposed to be describing an undisturbed orbit, in which case the area swept out by the radius vector is proportional to the first power of the time only, and its rate of change is therefore constant, as is also the projection upon the coordinate planes.

But

$$x\frac{d_1v_y}{dx}-y\frac{d_1v_x}{dt}$$

is proportional to the second differential with respect to the time of this area projected on the plane of xy, and therefore vanishes, as also do the corresponding quantities for the planes of yz and zx.

Also

$$\frac{d_2}{dt}\text{(velocity in any direction)}=\text{acceleration in that direction due to perturbation.}$$

Hence if X, Y, Z be the perturbative accelerations parallel to the respective coordinate axes, our equations are simplified to

$$\frac{d\mathrm{P}}{dt}\cos i-\mathrm{P}\sin i\frac{di}{dt}=x\mathrm{Y}-y\mathrm{X}$$

$$\frac{d\mathrm{P}}{dt}\sin\Omega\sin i+\mathrm{P}\cos\Omega\sin i\frac{d\Omega}{dt}+\mathrm{P}\sin\Omega\cos i\frac{di}{dt}=y\mathrm{Z}-z\mathrm{Y}$$

$$\frac{d\mathrm{P}}{dt}\cos\Omega\sin i-\mathrm{P}\sin\Omega\sin i\frac{d\Omega}{dt}+\mathrm{P}\cos\Omega\cos i\frac{di}{dt}=x\mathrm{Z}-z\mathrm{X}.$$

From the last two equations we deduce

$$\frac{d\mathrm{P}}{dt}\sin i+\mathrm{P}\cos i\frac{di}{dt}=(y\mathrm{Z}-z\mathrm{Y})\sin\Omega+(x\mathrm{Z}-z\mathrm{X})\cos\Omega,$$

whence by aid of the first equation

$$\mathrm{P}\frac{di}{dt}=(y\mathrm{Z}-z\mathrm{Y})\sin\Omega\cos i+(x\mathrm{Z}-z\mathrm{X})\cos\Omega\cos i-(x\mathrm{Y}-y\mathrm{X})\sin i.$$

Also

$$\mathrm{P}\sin i\frac{d\Omega}{dt}=(y\mathrm{Z}-z\mathrm{Y})\cos\Omega-(x\mathrm{Z}-z\mathrm{X})\sin\Omega.$$

Hitherto we have left the positions of the rectangular coordinate axes quite arbitrary, except that their point of intersection is at the Sun's centre. Our equations will be still further sim-

plified by a suitable choice of axes. First, let the axis of x be directed towards the ascending node of the instantaneous orbit upon the ecliptic.

Then

$$P\frac{di}{dt} = (xZ - zX)\cos i - (xY - yX)\sin i,$$

and

$$P\sin i\frac{d\Omega}{dt} = yZ - zY.$$

Next, if we adopt the plane of the instantaneous orbit as the plane of xy, we have still more simply

$$P\frac{di}{dt} = xZ.$$

$$P\left[\sin i\frac{d\Omega}{dt}\right] = yZ.$$

Sin $i\,d\Omega$ is the projection of the perturbation of the node upon a great circle perpendicular to the plane of the instantaneous orbit.

There now only remains to determine the disturbing acceleration Z; X and Y now no longer appearing in our equations.

The fundamental equations of notion referred to axes originating in the Sun's centre are

$$\frac{d^2z}{dt^2} + k^2(1+m)\frac{z}{r^3} = k^2\Sigma m'\left(\frac{z'-z}{\rho^3}\right) - \frac{z'}{r'^3},$$

ρ being the distance between the disturbing and disturbed planets with two similar equations for x and y.

We will consider only one disturbing planet, the results for several planets merely requiring to be added together.

Then

$$Z = k^2m'\frac{z'-z}{\rho^3} - \frac{z'}{r^3}.$$

But as we have adopted the instantaneous plane of the orbit as the plane of xy, we have

$$z = 0.$$

Also if u be the argument of latitude,

$$x = r\cos u,\ y = r\sin u,$$

and substituting for P its value

$$k\sqrt{p(1+m)},$$

we have finally

$$\frac{di}{dt} = \frac{Kkm'}{\sqrt{p(1+m)}}z'r\cos u,$$

$$\sin i\frac{d\Omega}{dt} = \frac{Kkm'}{\sqrt{p(1+m)}}z'r\sin u,$$

where

$$K = \frac{1}{\rho^3} - \frac{1}{r^3}.$$

We might also have determined from the above equations the value of

$$\frac{dP}{dt},$$

and thence

$$\frac{dp}{dt},$$

and thus have found a relation between the variations of the major axis and the eccentricity. Thus our equations really determine the variations of three of the six elements of the orbit.

On the Variation of Latitude by the Greenwich Transit-Circle Observations. By S. C. Chandler.

The interesting communication of Messrs. Thackeray and Turner in the *Monthly Notices* for November 1892 was manifestly prepared before seeing the final law of the variation of latitude in No. 277 of the *Astronomical Journal*. I trust they will not deem it an encroachment on their province to point out that the general accordance of the observations with the provisional law of No. 267, which they have used, is still more satisfactory when the comparison is made with the definitive law. Without presuming to make a refined discussion, for which astronomers will look with interest to the continuation of the investigation by Messrs Thackeray and Turner, I find that the data of their Plate I. may be very satisfactorily represented by the expression

$$+0''\cdot09-0''\cdot141\cos(t-1885\text{ Apr. }23)\times0^{\circ}\cdot835-0''\cdot148\cos(\odot-300^{\circ})\quad(A)$$

The law on p. 100, *Astronomical Journal*, No. 277, gives

$$-0''\cdot120\cos(t-1885\text{ Apr. }9)\times0^{\circ}\cdot835-0''\cdot110\cos(\odot-350^{\circ}).$$

The testimony of these observations is consequently entirely in harmony with the law in question, as will strikingly appear if the curve computed from equation (A) be entered upon Plate I. in the November *Monthly Notices*. Such a chart is given on Plate III.* The curve of equation (A) is represented by a dotted line; the observations by a zigzag continuous line, taking for the points of the latter the means of each successive three points, as given by Messrs. Thackeray and Turner, in order to eliminate, unobjectionably, the larger accidental errors.

These results tend still further to confirm the doubt expressed on p. 71, *Astronomical Journal*, No. 273, as to whether temperature-variation plays any significant part in the apparently anomalous results of this instrument, as has always been supposed. This matter has been the subject of a good deal of past investigation, but never with distinctly satisfactory conclusions; and in view of the new light which this freshly discovered annual

[* It was pointed out by Mr. Thackeray, but, unfortunately, not until after this plate had been printed off, that the theoretical curve is apparently one year in error. The portion for 1891 really belongs to 1890, and so on.—Secretaries.]

term in the variation of latitude will probably throw on it, the problem must be again examined, and exhaustively. It is hoped that Messrs. Thackeray and Turner will again cover the already well-travelled ground back to 1851.

I beg to add a remark on an important point. It might be maintained that the annual term in the latitude-variation is illusory, and merely the indication of a generally prevailing instrumental disturbance, due to temperature, and affecting all instruments and methods alike. This would be possible, but, in view of the actual facts, it is not at all probable. This explanation would require the maximum and minimum phases to occur in midwinter and midsummer, and at the same dates in all longitudes. This is not the case. The American observations, with the apparent exception of one series, place these phases three or four months earlier than the European; indicating a rotation from west to east for this annual term, the same as has already been proved, from the observations, for the 427-day term, independently of the theoretical considerations which require it to be so.

1892 *December* 26.

Latitude Variation and Greenwich Observations, 1851–91.
By W. Grasett Thackeray.

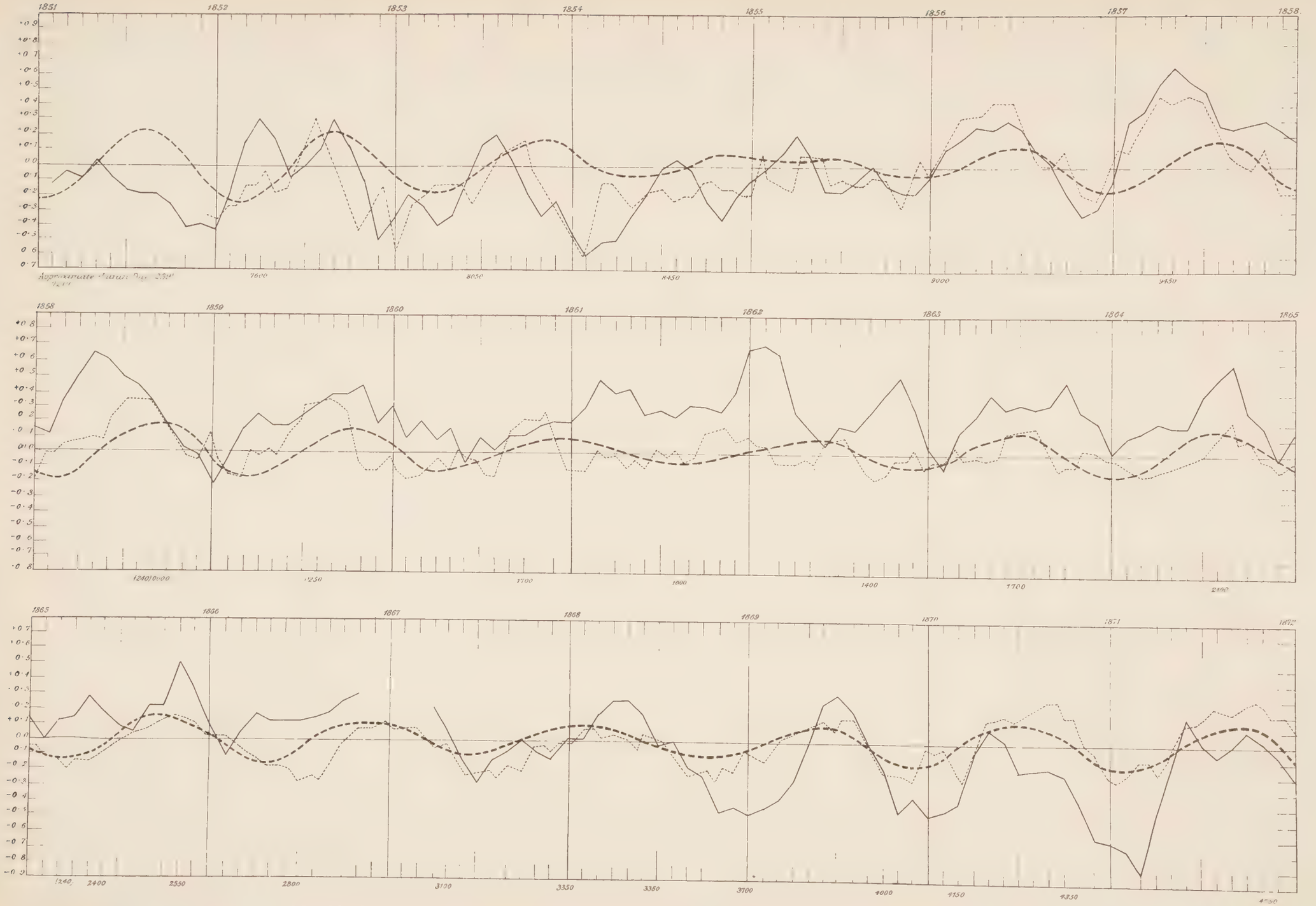
A preliminary paper on this subject was communicated to the Society in November last by Mr. Turner and myself. In it there was found to be indisputable evidence of the Chandler wave period, and grounds were shown for suspecting a five-yearly disturbance. This paper will be found to deal with—

1. The verification of the Chandler curve, as given in No. 277 of the *Astronomical Journal*;
2. The vindication of the correctness of the Greenwich Transit Circle Observations, more especially 1851–65.

1. The verification of the Chandler curve.

Since the publication of the first paper, the observations made at Honolulu and the allied observatories have added their testimony to the existence of a latitude variation, and Mr. Chandler in No. 277 of the *Astronomical Journal* has interpreted afresh the results of the laborious investigations he has undertaken on this subject. For a single term with a varying period he has substituted the resultant curve of two periodic fluctuations. The first of these two terms he has shown to have a period of 427 days and a semi-amplitude of about $0''{\cdot}12$; the second an annual period depending on the Sun's longitude with a semi-amplitude ranging between $0''{\cdot}04$ and $0''{\cdot}20$ during the last half century. In the same paper are also given curves showing the theoretical value of the latitude from 1840–1894 and the twenty-days' groups of observations from 1840–1891 upon which the theory was founded.

This theoretical curve and the observations on which it depends have been compared with the Greenwich observations as



Monthly differences of the four close circumpolar Stars with the Greenwich Transit Circle, 1851–1872, _____

Chandler's curve of 20 *day groups of Observations.*

Chandler's curve of Theory.

represented by the monthly means of the four close circumpolars *Polaris*, *Cephei* 51, δ *Ursæ Minoris*, and λ *Ursæ Minoris* for the years 1880–1891. The observations are taken from the N.P.D. ledgers of the volumes of Greenwich Observations, are reduced with Bessel's Refractions, and to the co-latitude value of 21″·90, and are not corrected for flexure or R—D: that is, where they have been corrected for flexure they have been recorrected to make the flexure = ·00. For discussions on the subject of the value of the correction for flexure as derived from the observations on the collimators, reference should be made to papers on Greenwich North Polar distances by Mr. Christie in *Memoirs R.A.S.*, vol. xlv., and by Professor Newcomb, in vol. ii. of the Astronomical Papers of the American N. A. office. The mean monthly values have been reduced to the epoch 1885. The precessions corresponding to the R.A. of each star at the middle of each year have been taken from Folie's Tables, and added together to reduce the results of the several years to the epoch 1885. The proper motions were taken from the Ten-Year Catalogue.

The differences between the monthly means thus reduced to 1885 and the adopted place for 1885 were then formed by taking monthly mean minus adopted place, both for above and below pole observations, and were combined with weights according to the number of observations.

The adopted places for 1885 were as follows:—

					°	′	″
Polaris	...	...	...	...	1	18	16·15
Cephei 51	...	...	...	...	2	46	33·98
δ Ursæ Minoris	...	...	...	...	3	23	22·27
λ Ursæ Minoris	...	...	...	...	1	2	40·18

As these stars are all close to the pole, any correction as now applied for R—D or flexure will be practically the same for all of them, and as the R—D variable term is found to be practically constant for these years, will only affect the zero line. Any error in the adopted places will, however, affect the form of the curve unless the above and below pole observations in any month are equal. Separate curves were also formed including and excluding the daylight observations of *Polaris* and *Polaris s. p.*, from which it was evident that there was no systematic error due to the daylight observations.

These differences, the same as were published in the first paper in November, were finally smoothed by taking the means of every three. It may be remarked that from the end of 1885 to the beginning of 1889 Mr. Chandler appears to have had no observations under investigation. The general accordance between all three curves is wonderfully good, and therefore the divergence of the Greenwich Observations at the beginning of 1881 is to be scanned with the more critical eye.

Mr. Chandler's curves representing theory and the twenty-days' groups of observations have been copied direct from his paper. It was occasionally found a little difficult to follow the latter.

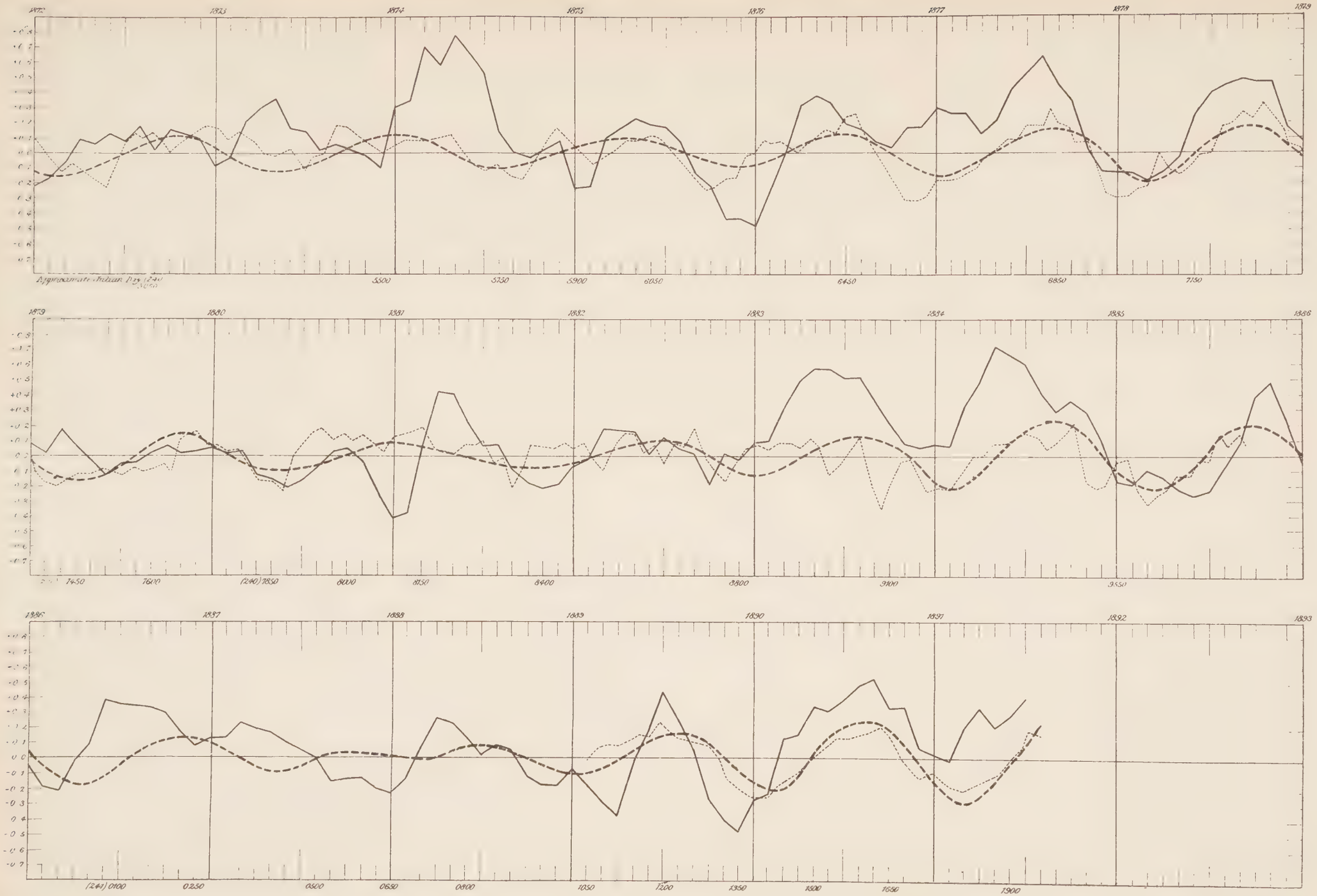
2. The vindication of the correctness of the Greenwich

Transit Circle observations in general, and those for 1851–1865 in particular.

On page 86, No. 251 of the *Astronomical Journal*, Mr. Chandler makes remarks to the following effect:—That the Greenwich observations with the Transit Circle for 1851–65, complicated with instrumental error and large accidental errors of observation, seem to frustrate efforts to get any pertinent results. We at Greenwich have noticed for some time a disposition among foreign astronomers to disparage the Greenwich observations. Scattered up and down foreign astronomical literature remarks such as the following may be found far too frequently:—The results are not accordant; the instrumental errors are complicated; the accidental errors are large and abundant; the observations have been rejected. To such I would remark that uniformity is not synonymous with truth, and that systematic errors are oftentimes the penalty of close agreement; it is to discordant and not to accordant observations that astronomy owes its most brilliant discoveries. In the volume of *Greenwich Observations* every step in the reductions is clearly set down, and the details of all instrumental errors carefully published. A discordant observation at Greenwich has never been rejected simply because it was discordant; but all results have been published, so that anybody using the observations can exercise his own discretion in retaining or rejecting such observations. The fact that Mr. Chandler has, after careful consideration, rejected sixteen years of observations with the Greenwich Transit Circle in such an important investigation as that on which he is engaged, and prefers to use the results of the Reflex Zenith Tube, is so striking that it becomes imperative to closely inquire into the subject. For this purpose I have taken the observations of the four close circumpolars as the representatives of the Greenwich Transit Circle observations.

The observations now under discussion comprise the rest of the series of the Greenwich Transit Circle observations—that is, from 1851–1879. The same stars have been used, the same method of reduction adopted, Bessel's Refractions, colatitude $21''\cdot90$, and no correction for flexure or R – D. The observations from 1851–1867 have all been reduced to the epoch 1860, and the observations from 1868–1879 to the epoch 1875. The precessions have been found in the same way, and the results found in an exactly similar manner, and compared with Mr. Chandler's curves representing his latest theory (that is law of eq. 15, *A. J.*, No. 277), and the twenty-day groups of observations on which his theory is based. The following are the adopted places of the stars at the two epochs:—

Epochs	1860	1875
	° ′ ″	° ′ ″
Polaris	1 26 12·90	1 21 26·30
Cephei 51	2 45 6·00	2 45 55·30
δ Ursæ Minoris	3 23 53·20	3 23 32·50
λ Ursæ Minoris	1 6 35·23	1 4 8·40



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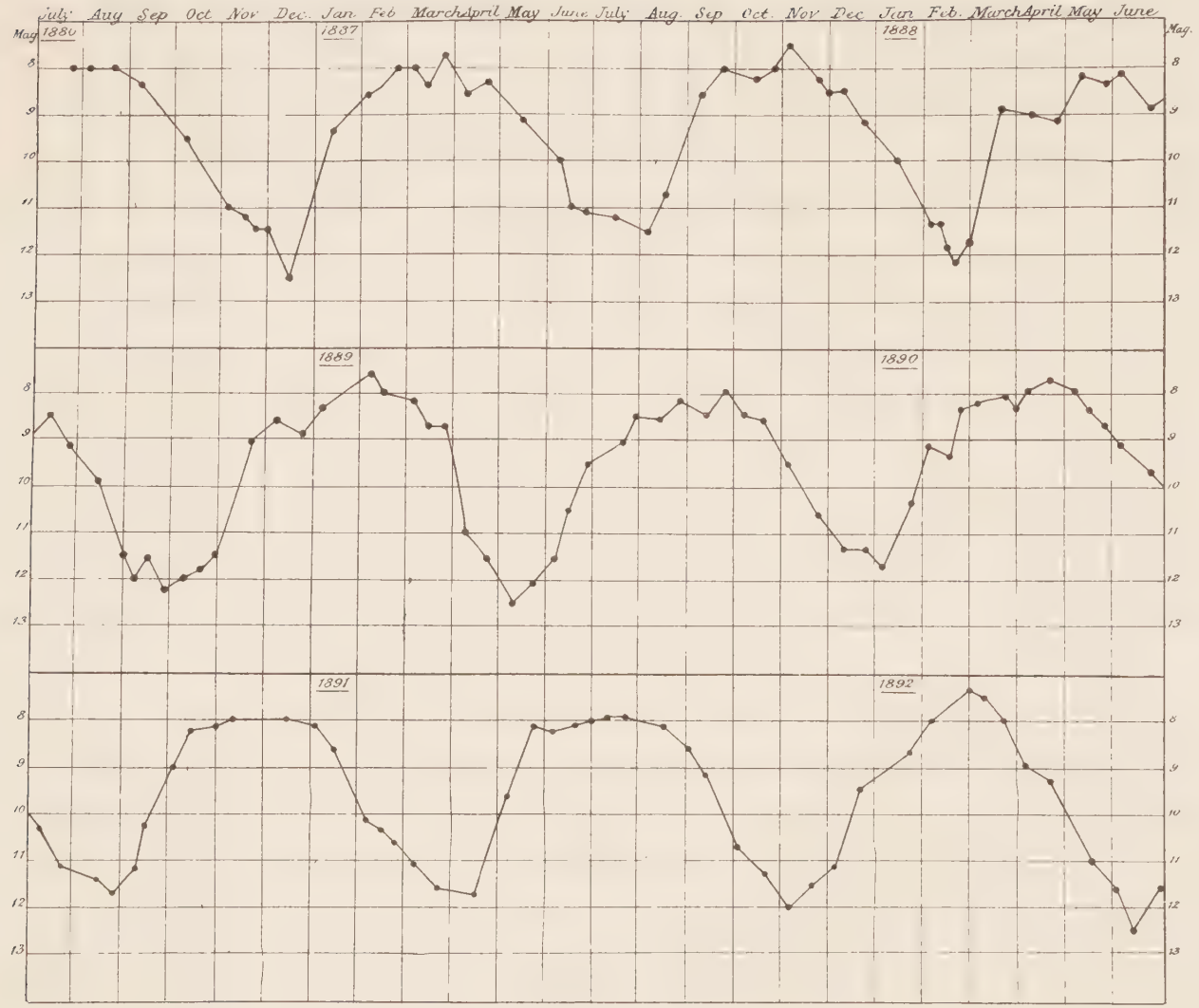
Monthly differences of the four close circumpolar Stars with the Greenwich Transit Circle, 1872–1892. ———
Chandler's curve of 20 *day groups of Observations.* .....
Chandler's curve of Theory. – – – –



S. Ursæ Majoris.

For the years 1868–1874 an additional correction, due to wear of the micrometer screws, is required, for particulars of which reference can be made to the Nine-Year Catalogue, 1872, in the introduction to which catalogue will be found a full and complete explanation. The results of the Greenwich observations thus corrected and reduced to one homogeneous system, when compared with the observations which Mr. Chandler has gathered together from all parts of the world, show a wonderful similarity of contour and general agreement in detail, the more remarkable when it is considered that many of the observations so collected by Mr. Chandler were made for special purposes with special instruments, with a special view to a discussion of this character. The agreement between all the curves is so good that the deviations become all the more accentuated, and, as Mr. Chandler remarks, in speculations on this subject it seems desirable to hold to a prudent reserve for further investigation. Incidentally to this investigation several other important questions have arisen, which are still under discussion.

Nova Aurigæ. By Isaac Roberts, D.Sc., F.R.S.

A photograph of the region of *Nova Aurigæ* was taken on October 3, 1892, with the 20-inch reflector, and exposure of 110 minutes, upon which the *Nova* appears as a star, as well defined as any of the other stars, which are very numerous, on the plate. There is no trace of nebulosity surrounding the *Nova*, or in its vicinity, and there is no feature about it suggestive that it is different from other stars. The diameter of its photo-image measures 21 seconds of arc, and about 85 seconds distant from it, on the *n.f.* side, is a star the photo-image of which measures 23 secs. of arc; the *Nova* is therefore 2 seconds in diameter less than the star.

On December 25, 1892, another photograph was taken of the same region, with an exposure of 20 minutes, upon which the *Nova* has a photo-image of 13 seconds of arc in diameter, and the star referred to has a diameter of 16 seconds. If we proportion the measured diameters obtained on the days stated, we shall have the following:—

$$23'' : 16'' :: 21'' : 14''{\cdot}63, \text{ the diameter of } Nova.$$

But the diameter of the *Nova* measures only 13 seconds, which shows a decrease of $1''{\cdot}63$ in diameter between October 3 and December 25.

There is no indication of nebulosity round the *Nova*, or in its vicinity, on the December plate, and it appears as sharply defined as the other stars.

So far, therefore, as the evidence obtained by the eleven

photographs which I have taken between the date of the appearance of the *Nova* and December 25, there is nothing upon them indicative of a disturbance, such as we might expect to see recorded if a body of the magnitude and velocity of the *Nova* had rushed into a nebula, or into a swarm of meteors. On the other hand, it might be argued that the great velocity of the star would carry it through without causing such great disturbance at right angles to the line of flight, according to dynamic law, that a projectile at a high velocity will penetrate through a plate of iron, or of glass, without fracturing them in the manner that a projectile would at a low velocity. On this hypothesis the inrush of the nebulous or meteoric matter, to fill the vacuum created by the star, might account for the peculiar spectra which were observed.

Photograph of the Nebula H I. 55 *Pegasi.* By Isaac Roberts, D.Sc., F.R.S.

The photograph of this nebula, now presented, was taken with the 20-inch reflector on 1892 October 22, and exposure of 4 hours. The scale is 30 seconds of arc to one millimetre. R.A. $23^h\ 0^m$; Decl. N. $11°45'$, at the centre.

The nebula is No. 4892 in the General Catalogue, and is described as pretty bright, considerably large, much elongated towards 12° between two stars, irregularly round, two or three stars in it, pretty generally much brighter in the middle. It is figured in the *Phil. Trans.*, 1833, pl. 14, as a faint ray, with a faint star near each extremity.

Lord Rosse, in his "Observations of Nebulæ and Clusters," p. 170, describes the appearance of the nebula, and it is figured in the *Phil. Trans.* for 1850, pl. 36, fig. 4. The drawing shows a bright broad boundary on the following side, and on the preceding side of it a circle filled with spiral convolutions, strongly marked. A star is shown in the centre of the convolutions, but later observations, made between the years 1849 and 1876, do not with certainty confirm the spiral structure.

The photograph shows the nebula to be a faint ellipse, with a dense broad line, curved at both ends, forming the major axis. There is a star of about 15th magnitude in the centre of the axis, and there is also a fainter star in the preceding semi-ellipse, but there is no structure visible within it, such as that shown on the drawing by Lord Rosse, and it does not show the semi-ellipse on the following side, which is faintly visible on the photograph. The object is altogether a difficult one, either to see or to photograph.

Photograph of the Cluster H VI. 30 *Cassiopeiæ.*
By Isaac Roberts, D.Sc., F.R.S.

The photograph now presented was taken with the 20-inch reflector on 1892 November 26. Exposure 90 minutes. Scale 30 seconds of arc to one millimetre. R.A. $23^h\ 52^m$; Decl. N. 56° 8′, at the centre.

The following description is given by Sir John Herschel in the *Phil. Trans.* for 1833, p. 480 :—"A most superb cluster which fills the field and is full of stars; generally brighter in the middle but no condensation to a nucleus. Stars 11th to 18th magnitude.

Lord Rosse, in his "Observations of Nebulæ and Clusters of Stars," p. 177, describes the cluster as very coarse; stars quite distinct and no visible nebulosity; dark holes and jagged branches, but no regular arrangement.

The photograph shows the cluster to be in fair accord with the descriptions given by Herschel and Rosse as far as they apply; but in addition it shows patterns, consisting of lines, wreaths, and curves of stars, which on the negative are very prominent features. The photograph confirms the eye observations, that there is no nebulosity in the cluster, and, since it shows every star in its true relative position and magnitude, down to about the 16th, the further evolution of this cluster may henceforth be strictly followed by us and by our successors.

The Eclipse of the Moon, 1892 *November* 4–5. Observed at Sydney Observatory.

(*Communicated by H. C. Russell, B.A., F.R.S., Government Astronomer.*)

The weather was most unpromising for observation, owing to the ever-changing and too abundant clouds; however, at $11^h\ 45^m$ through a break in the clouds, a slight shade, the effect of the penumbra, was visible on the eastern limb of the Moon, and the first contact with the shadow was seen at $12^h\ 14^m\ 20^s$. At $12^h\ 17^m$ the first photograph was taken, and a few minutes later an extensive cirrus-cloud covered the Moon, and a large halo was visible for a time. The cloud continued to increase, and interfered very much with observation. There was no sign of coppery colour, the shadow being so dark—a very dark brown, almost black—that it entirely blotted out the Moon's limb and markings on the surface, which are usually seen through it on such occasions. At $12^h\ 43^m$ a partial break in the cloud gave opportunity for another photograph, exposed 30^s. At $12^h\ 53^m$ the Moon was half eclipsed and the clouds had become thicker, so much so that no features of the Moon were visible through the shadow or eclipsed part of the Moon. At $12^h\ 55^m$ another photograph was taken, and the exposure was increased to 1^m.

At $1^h\ 28^m$ A.M. the eclipse was announced to become total, but here the Moon did not become wholly involved in the shadow.* The white strip of Moon visible at the total eclipse travelled round the northern limb of the Moon as the eclipse proceeded.

At 2 A.M. clouds cleared a little, and it could be seen by its coppery tint that the Moon was passing gradually out of the very dark part of the Earth's shadow-cone into a lighter part, in which the usual coppery-red light was bright enough to illuminate the Moon. On the northern side of the Moon, and extending upwards, the red or coppery colour seemed to involve three-fourths of the Moon, and a few minutes later—$2^h\ 10^m$—the Moon had passed altogether out of the dark shadow, and the whole of it was visible in red light. At $2^h\ 12^m$, the end of total eclipse, the white patch already referred to was on the N.E. side, and the colours on the Moon were unusually beautiful. A minute white crescent on the N.E. was fringed by greenish-grey light, which seemed to extend the crescent half round the Moon and hold in its grasp a brilliant coppery-red ball, the whole Moon, of which the lightest red was next the greenish-grey crescent, presenting altogether the most beautiful view of an eclipsed Moon that I have ever seen. At $2^h\ 30^m$ A.M. clouds again covered the Moon until six minutes past 3 A.M. At $3^h\ 8^m$ A.M. another photograph was taken. The coppery colour had gone, and the shadow on the Moon looked nearly as black as it did at the beginning of the eclipse. At $3^h\ 24^m$ A.M. another photo was taken. The last contact was observed $3^h\ 26^m$ A.M., and the penumbra still cast a faint shadow over part of the Moon, and three minutes later clouds again claimed possession. Six successful photographs of the Moon were obtained.

Observatory, Sydney N.S.W.:
1892 *November* 5.

Estimations of Magnitude of Nova Aurigæ, made at the Radcliffe Observatory, Oxford. By E. J. Stone, M.A., F.R.S., Radcliffe Observer.

Estimations of the magnitude of the Nova have been made on the following nights: 1892 November 18, 26; December 9, 12, 22, 23; and 1893 January 2 and 10. The mean magnitude given by these observations is 9·7, and it would appear that no sensible changes of magnitude have taken place during the interval over which these observations extend.

Radcliffe Observatory:
1893 *January* 12.

[* The Superintendent of the *N. A.* kindly informs us that "the Moon's centre was north of the shadow's centre, so that the Moon's north limb was close to the edge of the shadow, and small errors in adopted values might make it visible. The diameter of the shadow is increased in a certain proportion for one thing, but this assumed enlargement probably varies with the atmospheric conditions at the time of each eclipse."—SECRETARIES.]

Observations of the Variable Star S Ursae Majoris. R.A. xii. 39. 7; Dec. 61° 41′ 8 N. By Cuthbert E. Peek, M.A.

The above is one of the long-period variable stars under regular observation, and the series just presented covers a period of six years, extending from 1886 July to 1892 June.

The sketch diagram appended shows most of the stars near the variable; several are conspicuous, and the field can be identified without difficulty. Six of the stars are to be found in Argelander's chart, and using these as a basis the magnitudes of the remainder were determined by taking the mean of several series of careful eye estimations. This was done in 1886, and on the receipt of Prof. Pickering's work, *Variable Stars of Long Period*, in 1891, several of the Rousdon magnitudes of these comparison stars were found to be identical with those determined at Harvard Observatory, the mean difference being ·5 magnitude in excess. The necessary correction has been applied throughout; these observations, therefore, are strictly comparable with those of Harvard College. It will be seen from the annexed table that the Harvard College magnitudes are only estimated to the nearest whole magnitude.

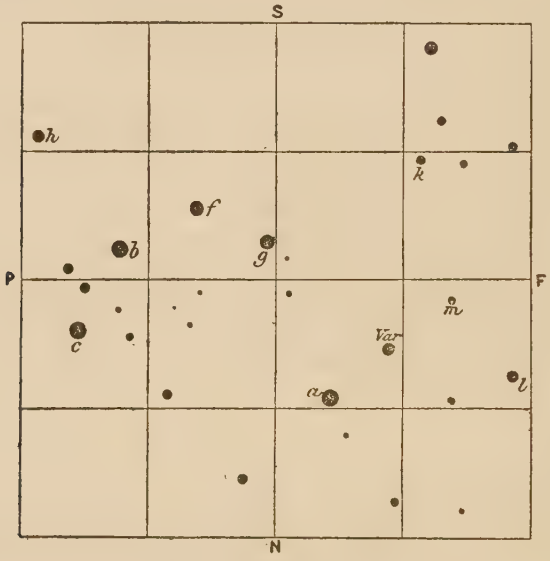
The light varies to the extent of about five magnitudes, the brightest maximum being 7·3 magnitude, and the faintest minimum 12·5 magnitude. It is always more or less red, and generally well defined, in contradistinction to some other variables which on several occasions have been noted as somewhat similar to a planetary nebula when other stars in the field could be brought to an absolutely sharp focus.

The observations were made with a $6\frac{4}{10}$ inch achromatic equatoreal telescope, the eyepieces commonly in use giving powers of 36, 80, and 136.

Argelander's method of observation has been followed throughout, the usual practice being to compare the variable with five other stars, the mean resulting magnitude being entered for the date given. Observations have been made on 146 nights, and 10 maxima and minima have been recorded. The dates of the maxima and minima given are the actual dates when the greatest and least brightness was observed. On the diagram the dots representing observations are simply joined by straight lines.

Several interesting irregularities are shown. The abrupt pause in the increase, and tendency to form small maxima, are well shown in 1887 February and March, and again in September and October. The pause in 1888 March and April was unusually long. About the maxima in 1890 November and 1891 July the light curve was much flatter than usual and the irregularities greatly diminished. At the maximum in 1892 March the contrary was observed, and the curve was more sudden than at any other maximum of this series. The light at various maxima has been observed to range from 7·5 to 8·2 magnitude.

Towards the minima several smaller irregularities are observed. A short pause is seen in the downward curve in 1886 November and 1888 February. At the minimum between these dates the light curve was abnormally flattened, and between June 16 and August 4 the star only declined ·5 magnitude. Before the minimum on 1888 September 30, the star showed a temporary minimum and sudden increase. It is open to question whether the magnitude given as the minimum on 1891 April 15 represents actually the least brightness, as the light curve seems to show that, had more frequent observations been possible, a lower magnitude would have been registered. The light at minimum has been observed to range from 11·5 to 12·5 magnitude.

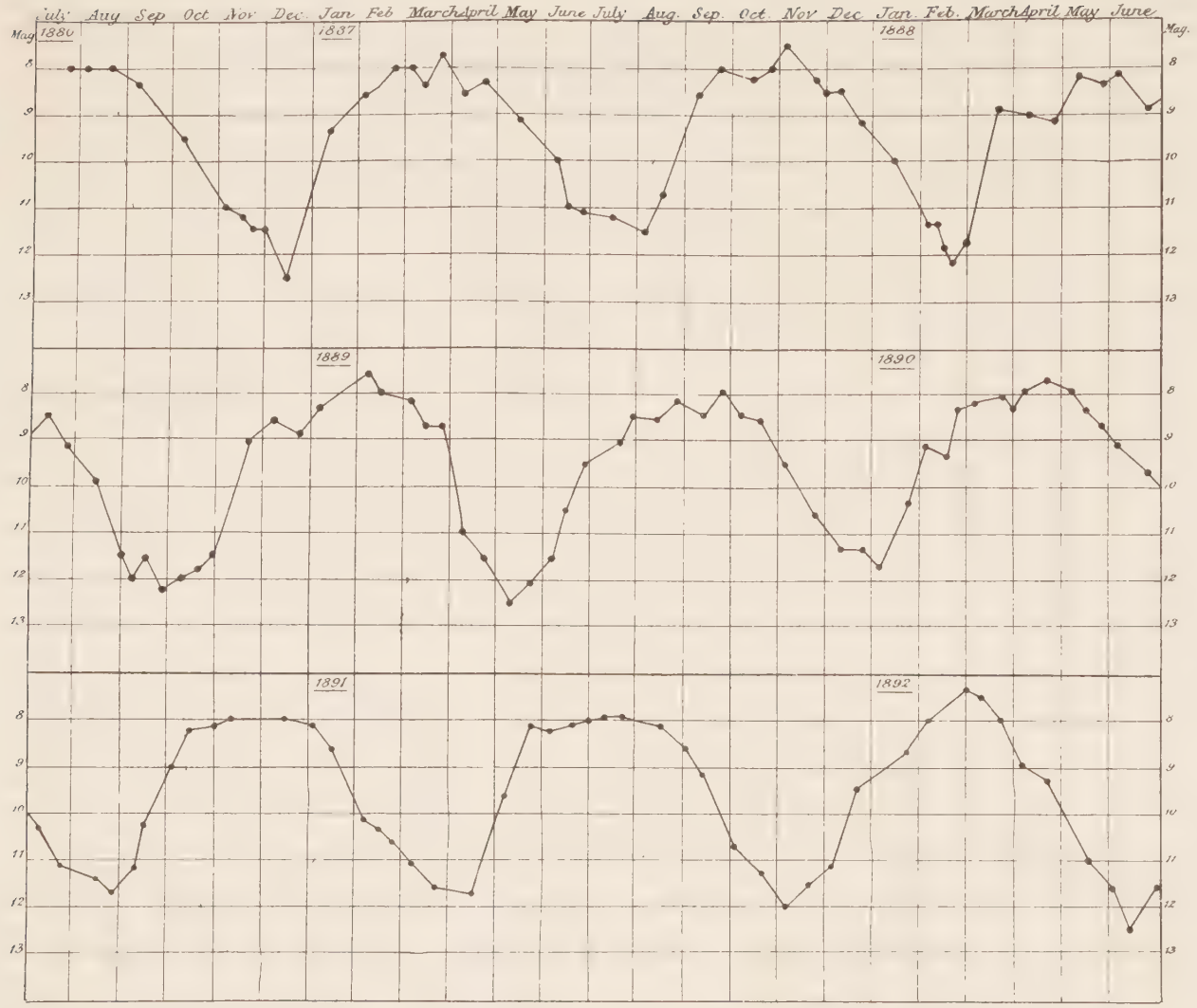


(One square degree.)

Harvard Magnitudes:

a	6 mag.	*c*	7 mag.	*g*	9 mag.	*k*	10 mag.
b	7 „	*f*	9 „	*h*	10 „	*l*	10 „
				m	11 mag.		

The table of maxima shows great irregularities, the intervals ranging from 212 to 240 days. The mean period, however, of the 10 maxima is 225·6 days, a result differing only ·8 day from the period given in *A Revised Catalogue of Variable Stars*, by J. E. Gore. The table of minima shows still greater irregularities. There is a difference of forty-seven days between the longest and shortest intervals, and at the minimum of 1889 May 10 the difference between the predicted and observed dates amounted to no less than sixty-two days.



S. Ursæ Majoris.

With regard to the actual observations, it may be mentioned that at the telescope the diagram, containing the stars indicated by letters, is alone used, the register of magnitudes being kept in the computing room. By this means an impartial observation is obtained, it being clearly impossible to remember the magnitudes of the (approximately) 300 comparison stars used in the observation of the variables on the working list.

The observations have been, in great part, made by my assistant, Mr. C. Grover, checked on all available opportunities by myself.

Observations of S Ursæ Majoris.

Maxima.

Date.	Mag.	Interval.	Predicted Date.	Authority.	Difference between Predicted & Observed.
		days			days
1886 Aug. 9	8·0	...	July 24	N. and C.O.	−16
1887 Mar. 27	7·8	230	Mar. 10	C.O.	−17
Nov. 1	7·6	219	Oct. 29	C.O.	− 3
1888 June 9	8·2	221	June 9	N. and C.O.	
1889 Feb. 4	7·6	240	Mar. 7	Sch.	+31
Sept. 22	7·9	230	Oct. 26	C.O.	+34
1890 April 22	7·7	212	April 27	C.O.	+ 5
Nov. 27	8·0	219	Dec. 9	C.O.	+12
1891 July 18	7·9	233	July 24	C.O.	+ 6
1892 Mar. 1	7·3	227	Mar. 6	C.O.	+ 5

N. = *Nature.*

C.O. = *Companion to the Observatory.*

Sch. = Schönfeld.

Observations of S Ursæ Majoris.

Minima.

Date.	Mag.	Interval.	Predicted Date.	Authority.	Difference between Predicted & Observed.
		days			days
1886 Dec. 15	12·5	...	Nov. 14	C.O.	−31
1887 Aug. 4	11·5	232	July 1	N. and C.O.	−34
1888 Feb. 16	12·2	196	Feb. 15	N. and C.O.	− 1
Sept. 30	12·3	227	Oct. 1	N. and C.O.	+ 1
1889 May 10	12·5	223	July 11	C.O.	+62
1890 Jan. 8	11·7	243			
Aug. 23	11·7	228	Aug. 24	C.O.	+ 1
1891 April 15	11·7	235	April 7	C.O.	− 8
Nov. 3	12·0	202	Nov. 19	C.O.	+16
1892 June 11	12·5	221	July 2	C.O.	+21

Comparison Stars for S Ursæ Majoris.

	Harvard.	Rousdon.
a	6·0	6·0
b	7·0	7·0
c	7·0	7·3
f	9·0	8·6
g	9·0	9·0
h	10·0	10·1
k	10·0	9·8
l	10·0	10·1
m	11·0	10·9

Rousdon Observatory, Lyme Regis:
1892 *September* 19.

The Geminid Meteor Shower, 1892 *December* 12.

By W. F. Denning.

The night of December 12 appears to have been clear over the country generally, and observations were obtained at many places. It is probable, however, that the Geminid display had then passed its maximum.

Professor A. S. Herschel, at Slough, watched the western sky during three hours of the interval between $10^h\ 45^m$ and $14^h\ 38^m$, and registered the paths of twenty-four shooting stars. Five others had been recorded earlier in the same night. The radiant of the Geminids was not very active nor its position sharply defined, most of the tracks of the conformable meteors having been observed at a considerable distance from it. Some conspicuous meteors were recorded which belonged to the numerous minor showers of the epoch, including Ursids, Leonids, Perseids, &c.

Mr. H. Corder, at Bridgwater, counted sixty-six shooting stars during watches covering about $5\frac{1}{4}$ hours (6^h to 8^h, and 10^h to $13^h\ 15^m$). He found the chief Geminid radiant at $109°+34°$ (38 meteors), and there was a secondary display at $117°+30°$ (12 meteors).

At Bristol I looked towards the eastern sky during a period equivalent to $1\frac{1}{2}$ hour between $9^h\ 45^m$ and $11^h\ 30^m$, and observed twenty shooting stars, of which about fifteen were Geminids. The chief radiant point was at $119°+29°$, $4\frac{1}{2}°$ E. of *β Geminorum*, and the centre of the true Geminids appeared to be indistinctly marked at $107°+34°$ from six tracks. The two showers are, I believe, quite separate; that from near *β Geminorum* usually gives brighter and longer meteors than the companion radiant N.W. of *α*. I had already seen this pair of contemporary

showers in the first half of December 1885, and on that occasion detected a third at 110°+25° (11 meteors).

The radiant of the true Geminids as independently determined by several observers this year on Dec. 12 was as under:—

Position. α δ	No. of Meteors.	Observer.	Place.
112°+38°	6	A. S. Herschel.	Slough.
109+34	38	H. Corder.	Bridgwater.
110+32	14	D. Booth.	Leeds.
107+32½	17	E. R. Blakeley.	Dewsbury.
109+30	5	W. H. Milligan.	Belfast.
107+34	6	W. F. Denning.	Bristol.

Evidence is not wanting to show that the diverging centre of this shower, like that of the great Perseid display in July–August, moves to the eastwards, but my observations of the earlier and later stages of the December stream are not sufficiently numerous to be conclusive on the point. I have certainly seen Geminids falling from α 103°—105° on the first few nights of December, whereas on the 9th the centre has been at α 107°, and on the 12th at α 109°. It is rather difficult to register the exact paths of these meteors, as they commonly traverse short, quick courses, and, except in regard to the brighter ones, streaks or trains rarely accompany them in their flights, so that there is nothing to guide the eye in its hurried effort to retain the directions accurately.

As to the neighbouring shower east of *β Geminorum*, this and previous years' observations define the mean place of it at 116°+30° from the following observations:—

Date.	Position. α δ	No. of Meteors.	Observer.
... December 7–13	118°+26°	13	Heis Cr_{23}.
1880 December 9	116+31	5	Backhouse.
1880 December 11	115+31	19	Backhouse.
1884 December 11	115+30½	...	Sawyer.
1885 December 7–8	115+33	11	D. 861.
1885 December 9–10	117+32	10	D. 877.
1892 December 12	117+30	12	Corder.
1892 December 12	119+29	8	D.

There is a well-pronounced shower, apparently from the same point in the sky, at the close of the year, for in 1886 December 22 to 29 I obtained a radiant at 115°+32° from seven slow meteors (=D. 907).

During recent observations the following bright meteors were recorded:—

Date. 1892.	G.M.T. h m	Magnitude.	Apparent Path. From α	From δ	To α	To δ	Probable Radiant.	Appearance.	Observer.
Dec. 9	7 30±	Very bright.	59½°	+21¾°	39½°	+2¾°	Gemini. 103° +38°.	Very slow, train.	"H.W.M."
	7 39±	1	85°	+35°	75°	+34°		Streak.	H.C.
	7 39	>1	81°	+32°	61°	+22°		Very slow, streak.	W.F.D.
	8 15±	1	70°	+71°	87°	+60°	333+73.	Slow, train, orange.	H.C.
	11 0	1	180°	+62°	209°	+59°	Gemini.	Orange.	H.C.
11	8 9	>1	71°	+16½°	62°	+10°	Gemini.	Streak.	H.C.
	9 23	1	343°	+35°	332°	+32°	Musca.	Streak.	H.C.
12	7 37	Capella.	95°	+43°	76½°	+47°	Gemini.	Streak, yellow.	H.C.
	9 54	1	130°	+19½°	132°	+17½°	Gemini.	Very slow, star-like.	W.F.D.
	10 10	2+♀	150°	+43°	188°	+41°	Gemini.	Rather slow.	D.B.
	10 51	>1	110°	+38°	109°	+44°	Gemini. 110½° +35°.	Very slow, streak, duration $2\frac{1}{2}^s$.	W.F.D.
	10 51¾	Sirius.	14°	+38°	359°	+27°		Streak, duration $1^s{\cdot}1$.	A.S.H.
	10 55±	1	135°	+46°	149°	+50°		Streak, yellow.	H.C.
	11 22	4	55°	+41°	45°	+20°	190+58.	Streak 1^s, duration $1^s{\cdot}2$.	A.S.H.
	11 39	4	19°	+1°	21°	−4°	16+7.	Wavy course, duration $1^s{\cdot}4$, intermittent light.	A.S.H.
	12 20	1½	58°	+59°	30°	+60°	Gemini.	White.	H.C.
	12 48	1	143°	−3°	148°	−10°	Gemini.	White.	H.C.
	13 28	1	210°	+68°	260°	+63°	153+42.	Streak, duration $1^s{\cdot}1$	A.S.H.
	14 18	Vega.	19°	+41°	25°	+27°	333+73.	Streak, duration $1^s{\cdot}5$	A.S.H.

Observers: Professor Herschel and Messrs. Corder, Booth, and Denning.

On comparing together all the available observations, three of the same meteors were found to have been observed at more than one station. On December 9, $7^h\ 39^m\pm$, a fine slow-moving Geminid, leaving a bright streak, was recorded at Bridgwater, Worcester, and Bristol. On December 12, $10^h\ 52^m\pm$, another bright member of this shower, estimated by Professor Herschel as equal to *Sirius*, was seen at Slough, Bridgwater, and Bristol, and on the same night, at $11^h\ 20^m$, a 2nd mag. Geminid was observed at Bridgwater and Bristol. Combining the various data, I have obtained the following results:—

Real Paths of 3 *Geminids*, 1892.

Particulars.	(1) Dec. 9. $7^h\ 39^m$	(2) Dec 12. $10^h\ 52^m$	(3) Dec. 12. $11^h\ 20^m$
Height at beginning	91 miles	60 miles	85 miles.
Position over	Ilford, Essex	Hungerford	5 miles north of Lynmouth.
Height at ending	57 miles	36 miles	44 miles.
Position over	Whitchurch, Hampshire	Chippenham	Lat. N. 51° 25′. Long. W. 4° 23′.
Earth point	Totnes	Magor, River Severn	10 miles south of Milford Haven.
Real length of path	75 miles	31 miles	50 miles.
Velocity per second	30 „	20 „	38 „
Radiant point	103° + 38	$110\frac{1}{2}° + 35°$	111° + 34°
Direction of flight from azimuth W. of S.	243°	277°	284°
Inclination (= alt. of radiant)	28	52	55

Bristol:
1892 *December* 26.

Observations of Brooks' Comet (g 1892) made at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The observations were made with the East, or Sheepshanks, Equatoreal, aperture 6·7 inches, by taking transits over two cross wires at right angles to one another, and each inclined 45° to the parallel of declination. Transits were occasionally taken also over a third wire, bisecting the angle between the other two wires. Magnifying power, 55.

Greenwich Mean Solar Time.	Observer.	☄−★ R.A.	Log. factor of Parallax.	Corr. for Refraction.	☄−★ N.P.D.	Log. factor of Parallax.	Corr. for Refraction.	No. of Comps.	Appt. R.A.	Appt. N.P.D.	Comp. ★
1892 d h m s		m s		s	′ ″		″		h m s	° ′ ″	
Dec. 12 14 37 25	H.	+0 33·59	9·6194	0·00	− 0 22·0	0·7598	0·0	6	13 40 44·45	61 23 43·1	*a*
12 14 45 12	,,	−0 53·17	9·6169	−0·01	− 8 17·5	0·7530	−0·1	8	13 40 44·54	61 23 5·2	*b*
12 15 8 33	,,	−3 1·58	9·6093	−0·01	−13 4·4	0·7326	+0·1	2	13 40 47·85	61 22 8·3	*c*
15 14 26 11	,,	+0 6·73	9·6380	+0·01	+ 5 50·9	0·7499	+0·1	3	13 51 15·95	57 40 11·3	*d*
15 18 1 28	A. C.	+0 28·26	9·3657	0·00	+ 3 51·2	0·5187	0·0	4	13 51 52·75	57 30 41·9	*e*
23 12 17 55	,,	+2 28·51	9·6483	0·00	− 1 4·3	0·8391	−0·1	4	14 35 39·40	44 54 1·1	*f*
23 12 17 55	,,	+1 11·56	9·6483	0·00	+ 1 19·3	0·8391	+0·1	4	14 35 39·52	44 54 3·3	*g*

Comparison Stars.

	Star's Name.	Mean R.A. 1892·0. h m s	Mean N.P.D. 1892·0. ° ′ ″	Authority.
a	W.B. (2) XIII. 810, 811	13 40 9·41	61 23 41·5	Weisse's Bessel
b	Lalande 25412	13 41 36·28	61 30 59·2	Lalande and Weisse's Bessel
c	Lalande 25467	13 43 48·01	61 34 49·1	Second Armagh Catalogue
d	Lalande 25647	13 51 7·79	57 33 55·0	Lalande
e	B.F. 1917	13 51 23·07	57 26 25·4	Greenwich Ten Year Catalogue, 1880
f	Radcliffe 3235	14 33 9·88	44 54 36·7	Radcliffe Catalogue and Bonn Observations, vol. vi.
g	O.A. (N.) 14741	14 34 26·96	44 52 15·2	Oeltzen-Argelander and Bonn Observations, vol. vi.

Notes.

The observations are corrected for refraction but not for parallax. They are also corrected for the error of inclination of the wires, and, where necessary, for the motion of the comet in N.P.D.

Dec. 12.—No nucleus to comet.

15.—Note by H.: Comet appeared fainter than on Dec. 12. No nucleus. Frequently difficult to see.
Note by A. C.: Comet pretty bright. Small. Central condensation.

23.– Comet fairly bright. Central condensation.

The initials H. and A. C. are those of Mr. Hollis and Mr. Crommelin respectively.

Royal Observatory, Greenwich:
1892 *January* 10.

Observations of Occultations of Stars by the Moon and of Phenomena of Jupiter's Satellites, made at the Royal Observatory, Greenwich, in the year 1892.

(*Communicated by the Astronomer Royal*).

Occultations of Stars by the Moon.

Day.	Phenomena.	Telescope.	Power.	Moon's limb.	Mean Solar Time of Observation. h m s	Observer.
1892 Feb. 1 (*a*)	Disapp. Piazzi XXIII. 190	E. Equat.	150	Dark	5 57 57·19	L.
1	,, Piazzi XXIII. 190	Altaz.	100	,,	5 57 57·36	H.
1 (*b*)	Reapp. Piazzi XXIII. 190	E. Equat.	150	,,	6 54 0·19	L.
7	Disapp. 118 Tauri (S ✱)	Altaz.	100	,,	12 45 27·84	H. T.
7	,, 118 Tauri (S ✱)	E. Equat.	150	,,	12 45 26·90	L.
7	,, 118 Tauri (N ✱)	Altaz.	100	,,	12 45 29·94	H. T.
7	,, 118 Tauri (N ✱)	E. Equat.	150	,,	12 45 28·99	L.
Mar. 8	,, ω^2 Cancri	,,	150	,,	8 14 46·44	H.
Apr. 2	,, 139 Tauri	Altaz.	100	,,	12 36 22·65	L.
2	,, 139 Tauri	E. Equat.	55	,,	12 36 22·97	A. C.
7 (*c*)	,, 42 Leonis	,,	55	,,	7 50 15·72	C. D.
May 11	,, B D −19° No. 4091	,,	55	,,	10 16 31·50	L.
11	,, B D −19° No. 4091	Altaz.	100	,,	10 16 32·02	B.
11	,, B D −19° No. 4093	Photo. Equat.	225	,,	10 20 26·16	C.
11 (*d*)	Reapp. B D −18° No. 4047	E. Equat.	55	,,	10 31 45.76	L.
11 (*e*)	Disapp. B D −19° No. 4095	Photo. Equat.	225	,,	10 34 56·27	C.
11	,, B D −19° No. 4095	E. Equat.	55	,,	10 34 57·73	L.
11	,, B D −19° No. 4095	Altaz.	100	,,	10 35 (4·01)	B.
11 (*f*)	,, B D −19° No. 4096	Photo. Equat.	225	,,	10 42 34·01	C.

Day.	Phenomena.	Telescope.	Power.	Moon's limb.	Mean Solar Time of Observation. h m s	Observer.
1892 May 11 (*g*)	Reapp. B D −19° No. 4087	Photo. Equat.	225	Dark	10 57 37·53	C.
11	Disapp. O A (S.) 14520	„ „	225	„	11 9 37·56	C.
11	„ O A (S.) 14525-6 (1st ✱)	E. Equat.	55	„	11 12 5·57	L.
11	„ O A (S.) 14525-6 (1st ✱)	Altaz.	100	„	11 12 (8·00)	B.
11	„ O A (S.) 14525-6 (2nd ✱)	Photo. Equat.	225	„	11 12 13·14	C.
11	Disapp. O A (S.) 14525-6 (2nd ✱)	E. Equat.	55	„	11 12 13·35	L.
11	Reapp. B D −19° No. 4091	E. Equat.	55	„	12 33 56·77	L.
July 3	Disapp. Uranus 1 L	Altaz.	100	„	9 8 4·82	H. T.
3	„ Uranus 1 L	Photo. Equat.	225	„	9 8 2·99	C.
3	„ Uranus 2 L	Altaz.	100	„	9 8 10·01	H. T.
3	„ Uranus 2 L	Photo. Equat.	225	„	9 8 11·46	C.
Aug. 11 (*h*)	Reapp. 14 Ceti	„ „	120	„	12 39 37·63	C. D.
Sept. 12	„ κ Tauri	E. Equat.	150	„	12 58 49 87	C. M.
15	„ ω^2 Cancri	Photo. Equat.	120	„	13 42 51·01	C. D.
Oct. 3	Disapp. τ^2 Aquarii	Altaz.	100	„	6 32 1·54	A. C.
Nov. 30	„ Piazzi I. 123 (1st ✱)	Photo. Equat.	225	„	8 8 21·63	C. D.
30	„ Piazzi I. 123 (2nd ✱)	„ „	225	„	8 8 22·13	C. D.
30	„ Lalande 2945	E. Equat.	150	„	8 26 26·86	A. C.
Dec. 25	„ B.A.C. 8214	„	150	„	6 4 9·68	T. H.

Notes.

(*a*) A very good observation. (*b*) Star faint, slight cloud; possibly half a second late; not a good observation.
(*c*) Observation made very hurriedly. (*d*) Observation very rough. (*e*) Considered a good observation.
(*f*) Star very faint. (*g*) Probably a little late; star a little way from limb. (*h*) Reappearance bright and instantaneous.

Phenomena of Jupiter's Satellites.

Day.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Jan. 7	II.	Tr. Egr. First seen	E. Equat.	150	5 21 59	5 20	L.
7	II.	Last contact	,,	,,	5 27 38		,,
June 27	II.	Ecl. D. Last seen	,,	55	14 13 16	14 12 51	B.
27 (*a*)	II.	Ecl. D. Last seen	Photo. Equat.	225	14 13 19	14 12 51	C. D.
30	III.	Tr. Egr. First seen	E. Equat.	150	13 21 5		A. C.
30	III.	Bisection	,,	,,	13 22 32	13 28	,,
30	III.	Last contact	,,	,,	13 25 14		,,
July 22	II.	Ecl. R. First seen	,,	,,	13 51 2		L.
22	II.	Bisection	,,	,,	13 52 32	13 48 55	,,
22	II.	Full brightness	,,	,,	13 53 36		,,
22	II.	Occ. D. First contact	,,	,,	14 5 5	14 6	,,
22	II.	Last seen	,,	,,	14 7 44		,,
Aug. 10	I.	Occ. R. First seen	,,	,,	13 21 33	13 21	B.
11 (*b*)	I.	Tr. Egr. First seen	Photo. Equat.	225	10 37 34		C. D.
11	I.	Bisection	,,	,,	10 39 6	10 40	,,
11	I.	Last contact	,,	,,	10 40 14		,,
12 (*c*)	III.	Tr. Egr. Last contact	,,	,,	12 50 46	12 53	,,
25	II.	,, First seen	E. Equat.	150	9 48 12		L.
25	II.	Bisection	,,	,,	9 51 26	9 52	,,
25	II.	Last contact	,,	,,	9 55 11		,,

Day.	Satellite.	Phenomenon.		Telescope	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Aug. 30 (*d*)	II.	Ecl. D.	Began to fade	Photo. Equat.	225	13 29 52	13 32 12	C. D.
30	II.		Last seen	,,	,,	13 32 24		,,
Sept. 6	III.	Occ. D.	First contact	E. Equat.	150	11 14 37	11 23	L.
6	III.		Last seen	,,	,,	11 19 51		,,
6	III.	Occ. R.	First seen	,,	,,	12 54 22	13 7	,,
6	III.		Last contact	,,	,,	13 7 35		,,
13	III.	Ecl. D.	Last seen	,,	,,	11 39 1	11 38 13	R. C.
17 (*e*)	II.	Ecl. D.	Last seen	,,	,,	7 58 33	7 59 53	A. C.
17	II.	Ecl. D.	Last seen	Photo. Equat.	225	7 58 34	7 59 53	A. E.
17	II.	Occ. R.	First seen	E. Equat.	150	11 40 4	11 41	A. C.
17	II.		Last contact	,,	,,	11 41 59		,,
17 (*f*)	II.	Occ. R.	First seen	Photo. Equat.	225	11 39 48	11 41	A. E.
17	I.	Tr. Ing.	First contact	E. Equat.	150	11 47 44		A. C.
17	I.		Bisection	,,	,,	11 49 3	11 49	,,
17	I.		Last seen	,,	,,	11 50 44		,,
24 (*g*)	III.	Tr. Ing.	First contact	,,	,,	8 0 23	7 58	,,
24	III.		Last seen	,,	,,	8 7 50		,,
24	III.	Tr. Egr.	First seen	,,	,,	9 38 36		,,
24	III.		Bisection	,,	,,	9 41 26	9 42	,,
24	III.		Last contact	,,	,,	9 43 2		,,
24 (*h*)	II.	Ecl. D.	Began to fade	,,	,,	10 32 46	10 35 1	,,
24	II.		Last seen	,,	,,	10 34 45		,,

Day.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Sept. 24	I.	Tr. Ing. First contact	E. Equat.	150	13 31 0		A. C.
24	I.	Bisection	,,	,,	13 33 34	13 33	,,
24	I.	Last seen	,,	,,	13 35 2		,,
24	II.	Occ. R. First seen	,,	,,	13 53 41		,,
24	II.	Bisection	,,	,,	13 54 48	13 56	,,
24	II.	Last contact	,,	,,	13 57 17		,,
Oct. 1	III.	Tr. Ing. First contact	,,	,,	11 11 18		L.
1	III.	Bisection	,,	,,	11 16 27	11 13	,,
1	III.	Last seen	,,	,,	11 24 46		,,
1	III.	Tr. Egr. Bisection	,,	,,	13 0 10		,,
1	III.	Last contact	,,	,,	13 6 19	13 0	,,
1	II.	Ecl. D. Last seen	,,	,,	13 9 45	13 9 13	,,
3	I.	Tr. Ing. Bisection	,,	55	9 41 22		A. C.
3	I.	Last seen	,,	,,	9 42 55	9 42	,,
3	II.	Tr. Egr. First seen	,,	,,	10 34 46		,,
3	II.	Bisection	,,	,,	10 37 22	10 36	,,
3	II.	Last contact	,,	,,	10 40 4		,,
3	I.	Tr. Egr. First seen	,,	,,	11 51 19		,,
3	I.	Bisection	,,	,,	11 52 59	11 54	,,
3	I.	Last contact	,,	,,	11 54 21		,,

Day.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Oct. 9 (*i*)	I.	Ecl. D. Bisection	E. Equat.	150	14 7 32	14 8 15	T. H.
9	I.	Last seen	,,	,,	14 8 27		,,
18	I.	Occ. D. First contact	Photo Equat.	225	10 19 12		C. D.
18	I.	Bisection	,,	,,	10 21 27	10 21	,,
18	I.	Last seen	,,	,,	10 22 57		,,
18	I.	Ecl. R. First seen	,,	,,	12 41 54	12 41 39	,,
18	I.	Full brightness	,,	,,	12 43 34		,,
25	I.	Occ. D. Last seen	E. Equat.	150	12 5 3	12 5	B.
26	I.	Tr. Ing. Bisection	,,	220	9 19 38	9 18	A. C.
26	I.	Last seen	,,	,,	9 20 59		,,
26	II.	Occ. D. First contact	,,	,,	9 23 56		,,
26	II.	Bisection	,,	,,	9 26 14	9 28	,,
26	II.	Last seen	,,	,,	9 29 23		,,
26	III.	Occ. D. First contact	,,	,,	10 17 47		,,
26	III.	Bisection	,,	,,	10 20 59	10 23	,,
26	III.	Last seen	,,	,,	10 28 44		,,
Nov. 1	I.	Occ. D. First contact	,,	150	13 47 19		,,
1	I.	Bisection	,,	,,	13 49 6	13 50	,,
1	I.	Last seen	,,	,,	13 50 27		,,
18	I.	Tr. Ing. First contact	,,	,,	8 59 30		L.
18	I.	Bisection	,,	,,	9 1 55	9 0	,,
18	I.	Last seen	,,	,,	9 4 30		,,

Day.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Nov. 18 (*j*)	I.	Tr. Egr. First seen	E. Equat.	150	11 8 59		L.
18	I.	Bisection	,,	,,	11 13 4	11 13	,,
18	I.	Last contact	,,	,,	11 16 28		,,
27	I.	Tr. Egr. First seen	,,	220	7 23 57		L.
27	I.	Bisection	,,	,,	7 26 47	7 28	,,
27	I.	Last contact	,,	,,	7 29 36		,,
27	II.	Occ. D. First contact	,,	,,	7 44 21		,,
27	II.	Bisection	,,	,,	7 46 49	7 47	,,
27	II.	Last seen	,,	,,	7 48 37		,,
27 (*k*)	II.	Occ. D. First contact	Altaz.	100	7 47 45		T. H.
27	II.	Bisection	,,	,,	7 49 2	7 47	,,
27	II.	Last seen	,,	,,	7 50 27		,,
Dec. 3	I.	Ecl. R. First seen	E. Equat.	150	13 13 17	13 12 54	,,
6	II.	Tr. Egr. Last contact	,,	,,	7 42 39	7 41	A. C.
12	I.	Occ. D. First contact	Photo. Equat.	225	6 10 47		C. D.
12	I.	Bisection	,,	,,	6 12 2	6 12	,,
12	I.	Last seen	,,	,,	6 13 37		,,
13 (*l*)	II.	Tr. Ing. First contact	E. Equat.	150	7 31 30		C. M.
13	II.	Bisection	,,	,,	7 33 29	7 37	,,
13	II.	Last seen	,,	,,	7 36 12		,,
22	II.	Occ. R. First seen	,,	220	6 54 16	6 56	A. C.
22	II.	Last contact	,,	,,	6 56 5		,,

Day.	Satellite.	Phenomenon.	Telescope.	Power.	Mean Solar Time of Observation. h m s	Mean Solar Time of N.A. h m s	Observer.
1892 Dec. 22 (*m*)	II.	Ecl. D. Began to fade	E. Equat.	220	6 58 12	7 4 13	A. C.
22	II.	Last seen	,,	,,	7 2 23		,,
26 (*n*)	III.	Tr. Egr. First seen	,,	150	7 3 34	7 9	L.
26 (*o*)	III.	Last contact	,,	,,	7 11 23		,,
28 (*p*)	I.	Ecl. R. First seen	,,	220	7 59 22		,,
28	I.	Bisection	,,	,,	8 1 1	7 58 24	,,
28	I.	Full brightness	,,	,,	8 2 11		,,
29	II.	Occ. R. First seen	,,	150	9 28 43	9 29	T. H.
29	II.	Last contact	,,	,,	9 30 47		,,
29	II.	Ecl. D. Last seen	,,	,,	9 39 31	9 41 11	,,

Notes.

(*a*) A good observation. Definition very good. (*b*) Fairly good observation, but *Jupiter* was low down at the time.
(*c*) The satellite was first noticed at $12^h\ 45^m$. The first phase was lost owing to its reappearing so much earlier than was expected.
(*d*) A very good observation. (*e*) Not a good observation; *Jupiter* very low. (*f*) Satellite hung on the limb some time.
(*g*) The time noted is probably a little late. (*h*) Considered a good observation. (*i*) Not a good observation.
(*j*) Observation very rough. Satellite scarcely visible; thick fog. (*k*) Definition very bad; foggy.
(*l*) Satellite very faint; foggy. (*m*) Considered a fairly good observation. (*n*) A fairly good observation.
(*o*) Considered a very good observation. (*p*) Observations not of much value; foggy.

The initials H. T., C., L., H., A. C., B., T. H., C. M., C. D., R. C., and A. E. are those of Mr. Turner, Mr. Criswick, Mr. Lewis, Mr. Hollis, Mr. Crommelin, Mr. Bryant, Mr. Hudson, Mr. Martin, Mr. Davidson, Mr. Cheeseman, and Miss Everett respectively.

The aperture of the object glass of the East Equatoreal is 6·7 inches, and of the Altazimuth $3\frac{3}{4}$ inches. The abbreviation "Photo. Equat." denotes the guiding telescope of the Photographic Equatoreal, aperture 10 inches.

Observations of the Phenomena of Jupiter's Satellites at Bermerside Observatory, Halifax, in the year 1892. By Joseph Gledhill.

Day of Obs. 1892.	Satellite.	Phenomenon.	Phase.	G.M.T. of Observation. h m s	*N. Almanac* Time. h m s	Remarks.
Jan. 1	I.	Tr. I.	Ext. contact.	5 42 0	5 42	Poor definition.
			Int. contact.	5 44 30		
	I.	Sh. I.	Int. contact.	6 56 30	6 54	
Sept. 8	II.	Sh. I.	Int. contact.	10 33	10 27	Good definition.
	II.	Tr. I.	Ext. contact.	12 10 30	12 10	
			Bisection.	12 13		
			Int. contact.	12 15		
10	I.	Sh. I.	Int. contact.	9 18	9 16	Bad definition.
	II.	Oc. R.	Bisection.	9 25	9 25	
			Ext. contact.	9 27		
	I.	Tr. I.	Ext. contact.	10 6	10 4	
13	III.	Ec. D.	Fading?	11 34 30	11 38 13	Good definition.
			Fading.	11 36 30		
			Half gone.	11 38 30		
			Just gone.	11 40 47		
	III.	Ec. R.	First seen.	13 45 2	13 49 46	
			Half out.	13 48		
			Full brightness	13 53		
17	I.	Sh. I.	Int. contact.	11 11 30	11 10	Fair definition.
	II.	Oc. R.	Bisection.	11 40 30	11 41	
			Ext. contact.	11 41 30		
	I.	Tr. I.	Ext. contact.	11 48 30	11 49	
			Bisection.	11 50 30		
			Int. contact.	11 51 30		
24	III.	Tr. E.	Bisection.	9 35	9 42	Fair definition.
			Ext. contact.	9 43		
	II.	Ec. D.	Half gone.	10 33	10 35 1	
			Just gone.	10 35 15		
25	I.	Ec. D.	Fading?	10 15	10 18 11	
			Fading.	10 16		
			Half gone?	10 17		
			Just gone.	10 18 40		
26	I.	Tr. I.	Ext. contact.	7 58 30	7 59	
			Bisection.	8 0		
			Int. contact.	8 3		

Day of Obs. 1892.	Satel-lite.	Pheno-menon.	Phase.	G.M.T. of Observation. h m s	*N. Almanac* Time. h m s	Remarks.
Sept. 26	II.	Tr. E.	Int. contact.	8 18	8 20	
			Bisection.	8 21		
			Ext. contact.	8 24		
	I.	Sh. E.	Int. contact.	9 45	9 46	
			Just off?	9 47 30		
Oct. 4	I.	Oc. R.	Bisection.	9 3	9 5	Cloudy.
			Ext. contact.	9 5		
10	II.	Sh. I.	First seen on disc.	10 18	10 18	
			Int. contact.	10 20		
	II.	Tr. I.	Int. contact.	10 29	10 27	Cloudy.
11	I.	Ec. D.	Fading?	8 30	8 37 5	Fair definition.
			Fading.	8 32		
			Half gone.	8 34		
			Contact with planet?	8 35		
			Just gone.	8 36 54		
	I.	Oc. R.	First seen.	10 46	10 49	
			Bisection.	10 48		
			Contact.	10 50		
17	II.	Tr. I.	Ext. contact.	12 38	12 42	Good definition.
			Bisection.	12 40		
			Int. contact.	12 42		
	II.	Sh. I.	First seen.	12 54	12 56	
			Bisection?	12 55		
			Int. contact.	12 57		
	I.	Tr. I.	Ext. contact.	13 7	13 8	
			Bisection.	13 9		
			Int. contact.	13 10 30		
	I.	Sh. I.	First seen.	13 16	13 16	
			Bisection.	13 17		
			Int. contact.	13 18 30		
18	I.	Oc. D.	Ext. contact.	10 20	10 21	Fair definition.
			Bisection.	10 22		
			Just gone.	10 22 15		
	I.	Ec. R.	First seen.	12 40 50	12 41 39	Fair definition.
			Half out?	12 43		
			Full brightness?	12 47		

Day of Obs. 1892.	Satel-lite.	Pheno-menon.	Phase.	G.M.T. of Observation. h m s	*N. Almanac* Time. h m s	Remarks.
Oct. 19	III.	Ec. R.	First seen.	9 51 10	9 53 46	The satellite would have been seen some seconds sooner but for cloud.
			Half out?	9 53		
			Fully out?	9 56		
	I.	Sh. E.	Int. contact.	9 57	9 58	
	II.	Ec. R.	First seen.	10 4 31	10 3 7	Bad sky to-night.
			Half out.	10 7 0		
			Fully out.	10 8 30		
25	I.	Oc. D.	Ext. contact.	12 3 30	12 5	Fair definition.
			Bisection.	12 5 30		
			Just gone.	12 7 15		
28	II.	Sh. E.	Int. contact.	7 24	7 26	Cloudy.
Nov. 3	I.	Oc. D.	Contact.	8 14	8 16	Very bad definition.
			Just gone.	8 17		
4	II.	Sh. E.	Int. contact.	10 1	10 5	Cloudy.
11	I.	Tr. I.	Ext. contact.	7 13 30	7 13	Fair definition.
			Bisection.	7 15 30		
			Int. contact.	7 17 0		
	I.	Sh. I.	First seen.	7 57 0	7 58	
			Bisected.	7 58 30		
			Int. contact.	8 0 0		
	II.	Tr. I.	Ext. contact.	8 38 30	8 44	
			Bisection.	8 41 30		
			Int. contact.	8 43 30		
	I.	Tr. E.	Int. contact.	9 23 0	9 26	
			Bisection.	9 25 0		
			Ext. contact.	9 26 0		
	II.	Sh. E.	Int. contact.	10 6 30	10 10	
			Bisection.	10 8 0		
29	II.	Sh. I.	Int. contact.	4 51	4 50	Stormy.
	II.	Tr. E.	Int. contact.	5 6	5 12	Stormy.
			Ext. contact.	5 11		
	II.	Sh. E.	Int. contact.	7 16	7 19	Stormy.
Dec. 1	III.	Oc. R.	Ext. contact.	5 40	5 45	Very cloudy.
	III.	Ec. D.	Fading?	8 1	8 5 52	Very cloudy.
			Half gone?	8 5		
			Just gone.	8 9 18		

Day of Obs. 1892.	Satellite.	Phenomenon.	Phase.	G.M.T. of Observation. h m s	*N. Almanac* Time. h m s	Remarks.
Dec. 6	II.	Tr. I.	Ext. contact.	5 4	5 8	Bad definition.
			Bisection?	5 6		
			Int. contact.	5 8		
	II.	Sh. I.	First seen.	7 27 30	7 30	
			Int. contact.	7 29 30		
	II.	Tr. E.	Int. contact.	7 34	7 41	
			Bisection?	7 36		
			Ext. contact.	7 37		
	II.	Sh. E.	Int. contact?	9 52	9 58	
12	I.	Oc. D.	Ext. contact.	6 11	6 12	Much cloud passing.
			Bisection?	6 13		
			Last seen.	6 14 30		
	I.	Ec. R.	First seen.	9 38 6	9 37 39	A bad night.
			Half out?	9 41 0		
			Full?	9 44 30		
13	I.	Sh. I.	First seen.	4 37 30	4 37	Strong twilight.
			Int. contact.	4 39		
	I.	Tr. E.	Int. contact.	5 34	5 36	Bad definition.
			Bisection.	5 35		
			Ext. contact.	5 37		
	I.	Sh. E.	Int. contact.	6 45	6 50	Bad definition.
	II.	Tr. I.	Ext. contact.	7 32	7 37	
			Bisection.	7 35		
			Int. contact.	7 36 30		
15	II.	Ec. R.	First seen.	6 50 10	6 49 12	Bad sky.
			Half out?	6 51 30		
			Full?	6 53		
	III.	Oc. D.	Ext. contact.	10 46	10 48	Planet low.
			Bisection.	10 49		Much motion.
			Just gone.	10 53		Poor definition.
26	III.	Tr. I.	Ext. contact.	4 44 40	4 42	Fair definition.
			Bisection?	4 50		
			Int. contact.	4 53		
	I.	Oc. D.	Ext. contact.	9 57	9 58	Much motion.
			Bisection.	9 59		
			Last seen.	10 1		
	III.	Sh. I.	First seen.	10 14 30	10 15	Bad definition.
			Int. contact.	10 18		

Day of Obs. 1892.	Satellite.	Phenomenon.	Phase.	G.M.T. of Observation. h m s	*N. Almanac* Time. h m s	Remarks.
Dec. 27	I.	Tr. I.	Ext. contact.	7 9 30	7 7	Good definition.
			Bisection.	7 11 30		
			Int. contact.	7 12 30		
	I.	Sh. I.	First seen.	8 27	8 28	
			Int. contact.	8 30		
	I.	Tr. E.	Int. contact.	9 18	9 21	Definition not good.
			Bisection.	9 20		
			Ext. contact.	9 22 30		
28	I.	Ec. R.	First seen.	7 58 44	7 58 24	Some cloud.

Instrument: The $9\frac{1}{3}$ inch Cooke equatoreal refractor; power 240.

January 1.—Satellite I. was invisible at $6\frac{1}{2}^h$; was a little brighter than the limb of *Jupiter* at ingress.

September 8.—Satellite II. much brighter than limb of planet at ingress; its shadow was black all through its transit.

"Red Spot" exceedingly faint; preceding end central at $10^h \pm$; following end central at $10^h\ 35^m \pm$. Dark and bright spots on the belts.

September 10.—Satellite I. brighter than limb of *Jupiter* at ingress.

September 13.—"Red Spot" very faint and difficult to see.

September 24.—Satellite III. was visible throughout transit. A small bright circular spot, like a satellite in transit, was seen on the southern edge of the "Red Spot" zone; central about $9^h\ 30^m$.

September 26.—At $8^h\ 30^m$ Satellite I. was invisible on disc. At $9^h\ 40^m$ it was still invisible.

October 11.—Satellite I. much brighter than the adjacent limb of *Jupiter* at reappearance.

October 17.—Satellite II. much brighter than the limb when it passed on to the disc; soon grew faint; quite invisible half an hour after ingress.

Satellite I. very much brighter than the limb at ingress.

November 11.—Satellite I. brighter than the limb of *Jupiter* at ingress; invisible at 8^h and 9^h and till $9^h\ 15^m$.

Satellite II. much brighter than the limb of the planet at ingress; visible at 9^h; invisible at $9^h\ 15^m$.

November 29.—Satellite II. was invisible at $4^h\ 30^m$ and $4^h\ 50^m$.

December 6.—Satellite II. was invisible at 6^h and at 7^h.

December 13.—Satellite I. invisible from 4^h till $5^h\ 25^m$ during its transit.

Note on the Red Spot on Jupiter. By Joseph Gledhill.

This well-known object was carefully looked for as soon as the planet came into a good position for observation.

1892 July.—Could never obtain a view of the whole outline of the spot. No trace of colour.

August.—At moments of best definition portions of the outline were with difficulty seen.

September.—The preceding and following ends were glimpsed, but never the whole. On the 8th it was on the central meridian about $10^h\ 15^m$, but the observation was necessarily very uncertain.

September 13.—Red Spot very faint, but most of the outline was seen.

October.—A very difficult object; no colour; the ends were occasionally fairly seen.

November.—On the 10th it was probably on the central meridian about $8^h\ 15^m$; it was a mere glimmer of an outline, and seen only at best moments.

December 6.—The Red Spot was central about $9^h\ 55^m$; it was seen with great difficulty; perhaps the whole outline was seen at best moments, and there was also a slight tinge of warm colour. The time of central transit was therefore very difficult to observe.

Bermerside Observatory, Halifax.

Observations of the Phenomena of the Satellites of Saturn at Bermerside Observatory, Halifax, in the year 1892. By Joseph Gledhill.

Instrument, the $9\frac{1}{3}$ inch Cooke equatoreal refractor; powers 240 and 300.

These very difficult observations were begun in January, but, owing to cloudy weather and bad definition, no results worth recording were obtained till April; and it was soon very evident that the refractor was hardly capable of dealing with these phenomena.

April 4.—*Dione* E elongation. Difficult. In line at $8^h{\cdot}55$? Past at $9^h{\cdot}10$. *Enceladus* invisible.

April 8.—Moon not far from *Saturn*. *Tethys* not seen at 7^h when at E elongation.

Rhea θ. Not up at $8^h{\cdot}20$. Past at $8^h{\cdot}30$. Cloudy after 10^h.

April 9.—*Dione* ϵ. Seen with great difficulty. Moon very near *Saturn*. On tangent to end of ring (E) between $7^h{\cdot}50$ and $7^h{\cdot}55$.

April 10.—Cloudless. *Saturn* very beautifully seen.

Dione ζ. The satellite easily seen at $8^h{\cdot}40$, but as it got near the ring it became a difficult object. It was not on the tangent

at $8^h{\cdot}50$; on at $8^h{\cdot}55$? Certainly on at or just before 9^h. Could not see it distinctly after 9^h. Very strong moonlight. Could not see the satellite at all at 10^h and 11^h.

April 11.—*Tethys* θ. Cloudless. Satellite very near the end of the ring at $10^h{\cdot}50$. At 11^h satellite lost in the ring.

Tethys δ. At 12^h and up to $12^h{\cdot}50$ satellite could not be seen.

April 25.—Clear; good definition. *Dione* θ. Satellite quite bright. Difficult at $9^h{\cdot}30$ owing to its being so near the ring. Last seen at 10^h, when it was not quite on the tangent line. Cloudy after 11^h.

April 28.—Definition not good. *Titan* γ at $7^h{\cdot}2$ not seen. Nor *Enc.* η at $8^h{\cdot}4$.

Dione on reappearance from eclipse at $9^h{\cdot}9$ not seen.

Tethys θ. At $10^h{\cdot}6$ not seen.

Titan η. On tangent at $10^h{\cdot}9$ nearly? On at 11^h? Just past at $11^h{\cdot}5$? Past at $11^h{\cdot}10$.

April 29.—Good definition. *Tethys* ζ. Not up at $9^h{\cdot}12$. On line between $9^h{\cdot}15$ and $9^h{\cdot}20$.

Enceladus is now well seen, but it could not be seen when it got near the ring.

Tethys β. Could not see it when near the ball of the planet. *Dione* ζ. Definition bad. On the tangent line about $12^h{\cdot}40$.

April 30.—Good definition. *Enc.* ϵ. Satellite just visible. Thought it was on the tangent line about $9^h{\cdot}40$.

Tethys δ. It became invisible at $9^h{\cdot}54$ owing to its closeness to the ring.

May 1.—Good definition; some haze. *Tethys* β $8^h{\cdot}5$. Very difficult; lost sight of it at $8^h{\cdot}25$, when it was probably on the tangent line.

Tethys Sh. $10^h{\cdot}4$. Began to look for this at 9^h, and continued the watch till $10^h{\cdot}5$, but never saw it.

Tethys γ. Not seen.

May 10.—*Tethys* E. Not up at 9^h; up between $9^h{\cdot}5$ and $9^h{\cdot}10$.

May 14.— *Titan* η. Not quite on line at $9^h{\cdot}10$. Cloudy.

May 15.—Windy; often much cloud. *Dione* E. $9^h{\cdot}50$, not up; $9^h{\cdot}55$, up? 10^h, up? $10^h{\cdot}5$ past.

Tethys θ. Not on line at $10^h{\cdot}20$; very near ring at $10^h{\cdot}25$; lost in ring at $10^h{\cdot}30$.

May 18.—*Tethys* Sh. Watched for it from 8^h till 11^h; not seen. Planet getting low.

June 1.—Often cloudy. *Enc.* ζ $8^h{\cdot}2$; not seen.

Dione ζ, $8^h{\cdot}8$; on tangent at $8^h{\cdot}45$; not up at $8^h{\cdot}40$.

Tethys θ. Not up at $9^h{\cdot}55$. Last seen at 10^h, and it was not quite on the line then.

Dione β, $11^h{\cdot}1$; not seen; planet too low.

Ephemeris of Juno, near the time of Opposition, 1893; computed from the Corrected Elements published in "Monthly Notices," vol. l. p. 495.

(*Communicated by the Superintendent of the "Nautical Almanac."*)

At transit at Greenwich.

Date.	Apparent Right Ascension.	Apparent Declination.	Date.	Apparent Right Ascension.	Apparent Declination.
	h m s	° ′ ″		h m s	° ′ ″
Jan. 7	10 8 27·99	S. 0 11 53·1	Feb. 8	9 48 4·40	N. 3 17 26·7
8	10 8 9·88	0 8 58·8	9	9 47 13·34	3 27 3·9
9	10 7 50·14	0 5 49·5	10	9 46 22·19	3 36 47·4
10	10 7 28·78	S. 0 2 24·9	11	9 45 31·02	3 46 36·7
11	10 7 5·82	N. 0 1 14·9	12	9 44 39·91	3 56 31·3
12	10 6 41·28	0 5 10·0	13	9 43 48·93	4 6 30·7
13	10 6 15·18	0 9 20·3	14	9 42 58·13	4 16 34·2
14	10 5 47·55	0 13 45·9	15	9 42 7·61	4 26 41·0
15	10 5 18·42	0 18 26·6	16	9 41 17·43	4 36 50·8
16	10 4 47·82	0 23 22·4	17	9 40 27·66	4 47 2·9
17	10 4 15·78	0 28 33·1	18	9 39 38·37	4 57 16·7
18	10 3 42·33	0 33 58·7	19	9 38 49·62	5 7 31·5
19	10 3 7·53	0 39 39·0	20	9 38 1·48	5 17 46·9
20	10 2 31·42	0 45 33·9	21	9 37 14·02	5 28 2·2
21	10 1 54·04	0 51 43·0	22	9 36 27·30	5 38 16·9
22	10 1 15·43	0 58 6·3	23	9 35 41·36	5 48 30·4
23	10 0 35·66	1 4 43·3	24	9 34 56·26	5 58 42·2
24	9 59 54·76	1 11 34·0	25	9 34 12·08	6 8 51·8
25	9 59 12·78	1 18 38·0	26	9 33 28·85	6 18 58·6
26	9 58 29·80	1 25 55·0	27	9 32 46·62	6 29 2·1
27	9 57 45·86	1 33 24·6	28	9 32 5·43	6 39 2·0
28	9 57 1·00	1 41 6·4	Mar. 1	9 31 25·34	6 48 57·7
29	9 56 15·27	1 49 0·3	2	9 30 46·39	6 58 48·9
30	9 55 28·75	1 57 5·8	3	9 30 8·61	7 8 35·0
31	9 54 41·51	2 5 22·5	4	9 29 32·04	7 18 15·7
Feb. 1	9 53 53·58	2 13 49·9	5	9 28 56·72	7 27 50·6
2	9 53 5·04	2 22 27·8	6	9 28 22·68	7 37 19·3
3	9 52 15·94	2 31 15·5	7	9 27 49·95	7 46 41·4
4	9 51 26·36	2 40 12·8	8	9 27 18·56	7 55 56·6
5	9 50 36·35	2 49 19·0	9	9 26 48·54	8 5 4·7
6	9 49 45·98	2 58 33·7	10	9 26 19·92	8 14 5·3
7	9 48 55·30	N. 3 7 56·5	11	9 25 52·72	N. 8 22 58·1

Date.	Apparent Right Ascension.	Apparent Declination.	Date.	Apparent Right Ascension.	Apparent Declination.
	h m s	° ′ ″		h m s	° ′ ″
Mar. 12	9 25 26·97	N. 8 31 42·8	Apr. 15	9 25 56·60	N. 11 51 53·0
13	9 25 2·69	8 40 19·2	16	9 26 22·58	11 54 48·1
14	9 24 39·89	8 48 47·0	17	9 26 49·84	11 57 33·5
15	9 24 18·62	8 57 6·0	18	9 27 18·34	12 0 9·2
16	9 23 58·87	9 5 15·8	19	9 27 48·07	12 2 35·2
17	9 23 40·65	9 13 16·3	20	9 28 19·01	12 4 51·8
18	9 23 23·99	9 21 7·5	21	9 28 51·14	12 6 58·9
19	9 23 8·88	9 28 49·0	22	9 29 24·43	12 8 56·7
20	9 22 55·34	9 36 20·7	23	9 29 58·87	12 10 45·2
21	9 22 43·39	9 43 42·5	24	9 30 34·42	12 12 24·6
22	9 22 33·01	9 50 54·1	25	9 31 11·09	12 13 54·9
23	9 22 24·20	9 57 55·6	26	9 31 48·84	12 15 16·3
24	9 22 16·97	10 4 46·9	27	9 32 27·64	12 16 28·8
25	9 22 11·30	10 11 27·9	28	9 33 7·48	12 17 32·6
26	9 22 7·20	10 17 58·5	29	9 33 48·35	12 18 27·8
27	9 22 4·66	10 24 18·8	30	9 34 30·22	12 19 14·5
28	9 22 3·67	10 30 28·6	May 1	9 35 13·06	12 19 52·7
29	9 22 4·22	10 36 27·9	2	9 35 56·86	12 20 22·6
30	9 22 6·29	10 42 16·7	3	9 36 41·60	12 20 44·2
31	9 22 9·88	10 47 55·2	4	9 37 27·27	12 20 57·7
Apr. 1	9 22 14·97	10 53 23·2	5	9 38 13·85	12 21 3·1
2	9 22 21·55	10 58 40·8	6	9 39 1·32	12 21 0·5
3	9 22 29·60	11 3 47·9	7	9 39 49·67	12 20 50·0
4	9 22 39·12	11 8 44·7	8	9 40 38·87	12 20 31·7
5	9 22 50·10	11 13 31·0	9	9 41 28·91	12 20 5·6
6	9 23 2·52	11 18 7·0	10	9 42 19·79	12 19 32·0
7	9 23 16·36	11 22 32·7	11	9 43 11·48	12 18 50·8
8	9 23 31·61	11 26 48·2	12	9 44 3·97	12 18 2·0
9	9 23 48·25	11 30 53·4	13	9 44 57·23	12 17 5·8
10	9 24 6·28	11 34 48·5	14	9 45 51·27	12 16 2·4
11	9 24 25·67	11 38 33·4	15	9 46 46·06	12 14 51·7
12	9 24 46·41	11 42 8·3	16	9 47 41·58	12 13 33·9
13	9 25 8·50	11 45 33·1	17	9 48 37·83	N. 12 12 9·0
14	9 25 31·90	N. 11 48 48·0			

"*Nautical Almanac*" *Office*:
1893 *January* 5.

Ephemerides of the Five Inner Satellites of Saturn, 1893.

By A. Marth.

The results of the measures which may have been made during last year's important apparition of *Saturn* not being yet available, the present ephemerides are founded upon the same elements, except that of the longitude of the central meridian.

In the following tables P denotes the position-angle of the axis of *Saturn*; L + 180° the planetocentric longitude of the Earth referred to the assumed fundamental plane; Λ + 180° that of the Sun, or Λ − L the difference between the two. B and *B* denote the planetocentric latitude of the Earth and Sun above the fundamental plane.

Mr. A. S. Williams's observations of a series of surface markings indicate that their rate of motion has varied considerably from that of the preceding year, and that for the present the identification of the various markings is quite doubtful. Nevertheless, I have thought it better not to fail to give facilities to observers by furnishing in the last column the longitude of *Saturn's* central meridian corresponding to the motion of the most frequently observed markings. The adopted daily rate of rotation is 844°·80, corresponding to a period of $10^{h}\ 13^{m}\cdot64$.

Greenwich Noon 1893.	P	L	B	*B*	A−L	Long. of ♄'s Central Mer.	Diff.
	°	°	°	°	°	°	
Feb. 15	357·183	192·009	+8·802	+7·128	−3·899	34·22	4224·40
20	·161	191·806	8·684	7·200	3·546	298·62	·41
25	·135	191·570	8·551	7·272	3·160	203·03	·42
Mar. 2	·106	191·306	8·407	7·344	2·745	107·45	·42
7	·074	191·017	8·253	7·416	2·305	11·87	·42
12	·040	190·706	8·090	7·488	1·844	276·29	·41
17	357·005	190·378	7·921	7·560	1·366	180·70	·39
22	356·968	190·037	7·748	7·631	0·875	85·09	·38
27	·930	189·689	7·573	7·703	−0·376	349·47	·35
Apr. 1	·892	189·338	7·399	7·775	+0·126	253·82	·32
6	·855	188·988	7·228	7·846	0·626	158·14	·29
11	·818	188·645	7·062	7·918	1·120	62·43	·25
16	·782	188·312	6·904	7·989	1·603	326·68	·21
21	·748	187·995	6·755	8·061	2·071	230·89	·17
26	·716	187·697	6·617	8·132	2·520	135·06	·12
May 1	356·687	187·421	6·493	8·203	2·946	39·18	·07
6	·660	187·172	6·384	8·274	3·346	303·25	4224·02
11	·637	186·952	6·290	8·345	3·717	207·27	4223·98
16	·617	186·763	6·214	8·416	4·056	111·25	·93
21	·601	186·608	6·156	8·487	4·362	15·18	·87
26	·588	186·488	6·116	8·557	4·633	279·05	·82
31	·579	186·404	6·095	8·628	4·868	182·87	·78
June 5	356·574	186·357	6·093	8·699	5·065	86·65	·73
10	·573	186·348	6·110	8·769	5·225	350·38	·68
15	·576	186·376	6·147	8·839	5·347	254·06	·64
20	·583	186·442	6·203	8·909	5·432	157·70	·61
25	·594	186·546	6·277	8·980	5·479	61·31	·57
30	·608	186·686	6·369	9·050	5·490	324·88	·53
July 5	·627	186·861	6·478	9·120	5·466	228·41	·50
10	·649	187·071	6·604	9·190	5·407	131·91	4223·47
15	356·675	187·314	+6·745	+9·260	+5·314	35·38	

In the tables for the five inner satellites, a and b denote the semi-axis of the apparent orbits, $l-\mathrm{L}$ the orbital longitudes reckoned from the points which are in superior conjunction with the planet's centre or in opposition to the Earth in longitude. By adding to $l-\mathrm{L}$ the value of L from the preceding table, the longitudes l are found, which are corrected for the equation of light.

Greenwich Noon.	Semidiameter of Ball. Equat.	Phase.	Polar.	Semiaxis of Ring. Major.	Minor.	*Mimas.* a_1	b_1	l_1-L	Diff.
1893.	″	″	″	″	″	″	″	°	°
Feb. 15	9·19	0·021	8·32	21·19	3·24	28·96	+4·43	93·41	1910·34
20	9·25	·018	8·36	21·33	3·22	29·15	4·40	203·75	·36
25	9·31	·014	8·41	21·45	3·19	29·31	4·36	314·11	·38
Mar. 2	9·35	·011	8·45	21·56	3·15	29·46	4·31	64·49	·39
7	9·39	·008	8·49	21·65	3·11	29·59	4·25	174·88	·39
12	9·43	·005	8·52	21·73	3·06	29·69	4·18	285·27	·39
17	9·45	·003	8·54	21·78	3·00	29·77	4·10	35·66	·39
22	9·47	·001	8·55	21·82	2·94	29·82	4·02	146·05	·38
27	9·48	·000	8·56	21·84	2·88	29·85	3·93	256·43	·37
Apr. 1	9·48	·000	8·56	21·84	2·82	29·85	3·84	6·80	·34
6	9·47	·000	8·55	21·82	2·75	29·82	3·75	117·14	·33
11	9·45	·002	8·53	21·78	2·68	29·77	3·66	227·47	·30
16	9·42	·004	8·51	21·73	2·61	29·69	3·57	337·77	·27
21	9·39	·006	8·48	21·65	2·55	29·58	3·48	88·04	·23
26	9·35	·009	8·45	21·56	2·49	29·46	3·40	198·27	·19
May 1	9·30	·013	8·41	21·45	2·43	29·31	3·32	308·46	·16
6	9·25	·016	8·36	21·33	2·37	29·14	3·24	58·62	·11
11	9·19	·019	8·31	21·20	2·32	28·96	3·17	168·73	·07
16	9·13	·023	8·25	21·05	2·28	28·77	3·11	278·80	1910·03
21	9·07	·026	8·19	20·90	2·24	28·56	3·06	28·83	1909·98
26	9·00	·029	8·12	20·74	2·21	28·34	3·02	138·81	·94
31	8·92	·032	8·06	20·57	2·19	28·11	2·99	248·75	·90
June 5	8·85	·034	7·99	20·40	2·17	27·88	2·96	358·65	·85
10	8·77	·036	7·92	20·23	2·16	27·64	2·94	108·50	·81
15	8·70	·038	7·86	20·05	2·15	27·40	2·93	218·31	·77
20	8·62	·039	7·79	19·88	2·15	27·16	2·93	328·08	·73
25	8·55	·039	7·72	19·71	2·15	26·93	2·94	77·81	·70
30	8·47	·038	7·65	19·54	2·17	26·70	2·96	187·51	·66
July 5	8·40	·038	7·59	19·37	2·19	26·47	2·99	297·17	·62
10	8·33	·037	7·53	19·21	2·21	26·24	3·02	47·79	1909·60
15	8·26	0·035	7·46	19·05	2·24	26·03	+3·06	156·39	

Greenwich Noon. 1893.	*Enceladus* a_2	b_2	l_2-L	Diff.	*Tethys.* a_4	b_4	l_4-L	Diff.
	″	″	°	°	″	″	°	°
Feb. 15	37·15	+5·69	46·73	1313·95	45·99	+7·04	306·26	953·75
20	37·39	5·64	280·68	·97	46·28	6·99	180·01	·78
25	37·60	5·59	154·65	1313·99	46·55	6·92	53·79	·80
Mar. 2	37·79	5·53	28·64	1314·00	46·79	6·84	287·59	·82
7	37·96	5·45	262·64	·02	46·99	6·74	161·41	·83
12	38·09	5·36	136·66	·02	47·15	6·63	35·24	·84
17	38·19	5·26	10·68	·02	47·27	6·51	269·08	·84
22	38·26	5·16	244·70	·02	47·36	6·38	142·92	·84
27	38·29	5·05	118·72	·01	47·40	6·25	16·76	·84
Apr. 1	38·29	4·93	352·73	1314·00	47·40	6·11	250·60	·83
6	38·25	4·81	226·73	1313·98	47·35	5·96	124·43	·81
11	38·18	4·69	100·71	·96	47·27	5·81	358·24	·80
16	38·08	4·58	334·67	·93	47·14	5·67	232·04	·77
21	37·95	4·47	208·60	·90	46·98	5·53	105·81	·75
26	37·79	4·36	82·50	·87	46·78	5·39	339·56	·71
May 1	37·60	4·26	316·37	·83	46·55	5·26	213·27	·68
6	37·39	4·16	190·20	·80	46·28	5·15	86·95	·65
11	37·16	4·07	64·00	·76	45·99	5·04	320·60	·61
16	36·90	3·99	297·76	·72	45·68	4·94	194·21	·57
21	36·63	3·93	171·48	·67	45·35	4·86	67·78	·53
26	36·35	3·87	45·15	·63	45·00	4·79	301·31	·49
31	36·06	3·83	278·78	·59	44·64	4·74	174·80	·45
June 5	35·76	3·80	152·37	·55	44·27	4·70	48·25	·41
10	35·46	3·78	26·92	·51	43·89	4·67	281·66	·37
15	35·15	3·76	259·43	·47	43·52	4·66	155·03	·33
20	34·85	3·77	132·90	·43	43·14	4·66	29·36	·30
25	34·55	3·78	6·33	·39	42·76	4·68	261·66	·26
30	34·25	3·80	239·72	·36	42·39	4·71	134·92	·22
July 5	33·95	3·83	113·08	·33	42·03	4·74	8·14	·19
10	33·67	3·87	346·41	1313·29	41·68	4·79	241·33	953·15
15	33·39	+3·92	219·70		41·34	+4·85	114·48	

Greenwich Noon. 1893.	*Dione.* a_4	b_4	l_4-L	Diff.	*Rhea.* a_5	b_5	l_5-L	Diff.
	″	″	°	°	″	″	°	°
Feb. 15	58·90	+9·01	321·28	657·92	82·26	+12·59	44·34	398·68
20	59·28	8·95	259·20	·95	82·78	12·50	83·02	·71
25	59·62	8·86	197·15	·97	83·26	12·38	121·73	·73
Mar. 2	59·92	8·76	135·12	657·99	83·68	12·23	160·46	·76
7	60·18	8·64	73·11	658·01	84·04	12·06	199·22	·77
12	60·39	8·50	11·12	·02	84·33	11·86	237·99	·79
17	60·55	8·34	309·14	·03	84·55	11·65	276·78	·80
22	60·65	8·17	247·17	·02	84·70	11·42	315·58	·80
27	60·71	8·00	185·19	·03	84·78	11·17	354·38	·80
Apr. 1	60·71	7·82	123·22	·02	84·78	10·92	33·18	·80
6	60·65	7·63	61·24	658·01	84·70	10·66	71·98	·79
11	60·54	7·44	359·25	657·99	84·55	10·40	110·77	·77
16	60·38	7·26	297·24	·97	84·32	10·14	149·54	·76
21	60·17	7·08	235·21	·94	84·03	9·89	188·30	·73
26	59·92	6·91	173·15	·92	83·67	9·64	227·03	·70
May 1	59·62	6·74	111·07	·88	83·25	9·41	265·73	·68
6	59·28	6·59	48·95	·85	82·78	9·20	304·41	·64
11	58·91	6·45	346·80	·82	82·27	9·01	343·05	·61
16	58·51	6·33	284·62	·78	81·71	8·84	21·66	·58
21	58·08	6·23	222·40	·75	81·11	8·70	60·24	·54
26	57·63	6·14	160·15	·70	80·49	8·58	98·78	·50
31	57·17	6·07	97·85	·66	79·84	8·48	37·28	·46
June 5	56·70	6·02	35·51	·63	79·18	8·40	175·74	·42
10	56·22	5·99	333·14	·58	78·51	8·35	214·16	·39
15	55·73	5·97	270·72	·55	77·83	8·33	252·55	·35
20	55·25	5·97	208·27	·51	77·15	8·34	290·90	·31
25	54·77	5·99	145·78	·47	76·48	8·36	329·21	·27
30	54·29	6·02	83·25	·44	75·82	8·41	7·48	·23
July 5	53·83	6·07	20·69	·39	75·17	8·48	45·71	·20
10	53·38	6·14	318·08	657·36	74·54	8·57	83·91	398·18
15	52·94	+6·22	255·44		73·93	+8·68	112·09	

These values are to be interpolated for the times for which the apparent places of the satellites are required, when the position-angles p and distances s, or the rectangular coordinates x and y referred to the axes of the ball of *Saturn*, are found by means of the formulæ

$$s \sin (p-\mathrm{P}) = x = a \sin (l-\mathrm{L})$$
$$s \cos (p-\mathrm{P}) = y = b \cos (l-\mathrm{L}).$$

The adopted zero-meridian will pass the middle of the illuminated disc of *Saturn* at the following Greenwich mean times :—

1893.	h m	h m	1893	h m	h m
Feb. 15	9 15·3	19 28·8	Mar. 24	0 42·9	10 56·4
16	5 42·4	15 56·0	25	7 23·6	17 37·2
17	12 23·1	22 36·7	26	3 50·7	14 4·3
18	8 50·3	19 3·9	27	10 31·5	20 45·1
19	5 17·5	15 31·0	28	6 58·7	17 12·2
20	11 58·2	22 11·8	29	3 25·8	13 39·4
21	8 25·3	18 38·9	30	10 6·6	20 20·2
22	4 52·5	15 6·1	31	6 33·8	16 47·4
23	11 23·2	21 46·8	Apr. 1	3 1·0	13 14·6
24	8 0·4	18 14·0	2	9 41·7	19 55·3
25	4 27·5	14 41·1	3	6 8·9	16 22·5
26	11 8·3	21 21·8	4	2 36·1	12 49·7
27	7 35·4	17 49·0	5	9 16·9	19 30·5
28	4 2·6	14 16·1	6	5 44·0	15 57·6
Mar. 1	10 43·3	20 56·9	7	2 11·2	12 24·8
2	7 10·4	17 24·0	8	8 52·0	19 5·6
3	3 37·6	13 51·2	9	5 19·2	15 32·8
4	10 18·3	20 31·9	10	1 46·4	12 0·0
5	6 45·4	16 59·0	11	8 27·2	18 40·8
6	3 12·6	13 26·2	12	4 54·4	15 8·0
7	9 53·3	20 6·9	13	1 21·6	11 35·2
8	6 20·5	16 34·1	14	8 2·4	18 16·0
9	2 47·7	13 1·2	15	4 29·6	14 43·2
10	9 28·4	19 42·0	16	11 10·4	21 24·0
11	5 55·5	16 9·1	17	7 37·6	17 51·2
12	2 22·7	12 36·3	18	4 4·8	14 18·4
13	9 3·4	19 17·0	19	10 45·6	20 59·2
14	5 30·5	15 44·1	20	7 12·9	17 26·5
15	1 57·7	12 11·3	21	3 40·1	13 53·7
16	8 38·4	18 52·0	22	10 20·9	20 34·5
17	5 5·6	15 19·2	23	6 48·1	17 1·7
18	1 32·8	11 46·3	24	3 15·3	13 29·0
19	8 13·5	18 27·1	25	9 56·2	20 9·8
20	4 40·6	14 54·2	26	6 23·4	16 37·0
21	1 7·8	11 21·4	27	2 50·6	13 4·3
22	7 48·5	18 2·1	28	9 31·5	19 45·1
23	4 15·7	14 29·3	29	5 58·7	16 12·4

1893.	h m	h m	1893.	h m	h m
Apr. 30	2 26·0	12 39·6	June 1	1 29·3	11 42·9
May 1	9 6·8	19 20·5	2	8 10·3	18 23·9
2	5 34·1	15 47·7	3	4 37·6	14 51·3
3	2 1·3	12 14·9	4	1 4·9	11 18·6
4	8 42·2	18 55·8	5	7 46·0	17 59·6
5	5 9·5	15 23·1	6	4 13·3	14 27·0
6	1 36·7	11 50·4	7	0 40·7	10 54·4
7	8 17·6	18 31·2	8	7 21·7	17 35·4
8	4 44·9	14 58·5	9	3 49·1	14 2·8
9	1 12·1	11 25·8	10	10 30·1	20 43·8
10	7 53·0	18 6·7	11	6 57·5	17 11·2
11	4 20·3	14 34·0	12	3 24·8	13 38·5
12	0 47·6	11 1·2	13	10 5·9	20 19·6
13	7 28·5	17 42·2	14	6 33·2	16 46·9
14	3 55·8	14 9·4	15	3 0·6	13 14·3
15	10 36·7	20 50·4	16	9 41·7	19 55·4
16	7 4·0	17 17·7	17	6 9·0	16 22·7
17	3 31·3	13 45·0	18	2 36·4	12 50·1
18	10 12·3	20 25·9	19	9 17·5	19 31·2
19	6 39·6	16 53·2	20	5 44·9	15 58·6
20	3 5·9	13 19·5	21	2 12·3	12 25·9
21	9 46·8	20 0·5	22	8 53·3	19 7·0
22	6 14·1	16 27·8	23	5 20·7	15 34·4
23	2 41·4	12 55·1	24	1 48·1	12 1·8
24	9 22·4	19 36·0	25	8 29·2	18 42·9
25	5 49·7	16 3·3	26	4 56·6	15 10·3
26	2 18·0	12 31·6	27	1 24·0	11 37·7
27	8 59·0	19 12·6	28	8 5·1	18 18·8
28	5 26·3	15 39·9	29	4 32·5	14 46·2
29	1 53·6	12 7·3	30	0 59·9	11 13·6
30	8 34·6	18 48·2	July 1	7 41·0	17 54·7
31	5 1·9	15 15·6	2	4 8·4	14 22·1

In order to reduce the longitudes of the central meridian in the ephemeris for 1891–92 to the system here adopted, the longitudes require the corrections—

1891	Oct. 20	+ 60°	1892	Feb. 17	+ 180°
	Nov. 19	90		Mar. 18	210
	Dec. 19	120		Apr. 17	240
1892	Jan. 18	150		May 17	270
	Feb. 17	+ 180		June 16	+ 300
					0

The rate of rotation adopted in last year's ephemeris was founded upon the observations of Mr. A. S. Williams, made in 1891 May and June, and the corresponding longitudes of several spots are given on p. 61 of vol. lii. In order to reduce these longitudes of spots to the system of the present ephemeris, the following angles must be added:—

1891 May	7	+106°	June	6	+76°
	17	96		16	66
	27	+86		26	+56

In the following list of approximate Greenwich mean times of conjunctions (reckoned parallel to the polar axis of the ball) of the satellites with the end points of the equatorial diameter of the ball and with those of the ring, the letters α, β, γ, δ denote the positions of the satellites when they are in conjunction with the end points of the equator in the order "north following, south following, south preceding, and north preceding," and ϵ, ζ, η, θ the corresponding positions at the end points of the ring. "Sup." and "inf." denote the observable superior and inferior conjunctions with the centre of the ball or the passage across the direction of the polar axis. In the case of *Rhea* and *Dione* the times of "*e*" and "*w*," the greatest eastern and western elongations, are added.

The present apparition of *Saturn* is the last for more than a dozen years which affords sufficiently favourable opportunities to observers with powerful instruments to contribute to our better knowledge of *Saturn's* system by careful estimations of the times of the predicted conjunctions; *v.* vol. lii. p. 191. It would be a pity and a cause of just reproach if the opportunities were again neglected.

G.M.T.			G.M.T.			G.M.T.		
1893.	h		1893.	h		1893.	h	
Feb. 11	12·7	En. η	Feb. 13	16·6	Mi. θ	Feb. 16	12·0	Di. ζ
	13·6	Te. α		18·4	Di. ζ		12·3	Rh. ζ
	13·9	Mi. η	14	8·7	Rh. δ		12·4	Mi. θ
	15·6	Te. ϵ		9·6	Te. γ		14·2	Di. β
	21·0	Di. w		9·8	Mi. η		14·9	Rh. β
12	9·0	Rh. η		10·6	Rh. sup.		15·9	Di. inf.
	9·4	Te. β		11·6	Te. η		16·8	Rh. inf.
	9·5	Di. θ		12·6	Rh. α		17·5	Di. γ
	11·8	Di. δ		14·6	Di. w		17·9	En. ζ
	12·3	Te. γ		15·1	Rh. ϵ		18·3	Mi. ϵ
	12·6	Mi. η		15·2	Mi. θ		18·8	Rh. γ
	14·3	Te. η		16·6	En. θ	17	8·3	Di. w
	15·0	Di. α	15	9·0	En. ζ		10·3	En. θ
	15·2	En. ζ		10·4	Te. ϵ		11·0	Mi. θ
	17·2	Di. ϵ		10·9	Di. ϵ		16·7	En. ϵ
13	10·9	Te. α		13·7	Rh. e		16·9	Mi. ϵ
	11·2	Mi. η		13·8	Mi. θ		19·9	Rh. w
	12·9	Te. ϵ		15·3	En. η	18	9·1	En. η
	14·0	En. ϵ	16	8·9	Te. η		9·6	Mi. θ

G.M.T. 1893.	h		G.M.T. 1893.	h		G.M.T. 1893.	h	
Feb. 18	15·5	Mi. ϵ	Feb. 24	12·6	Mi. ζ	Feb. 28	15·7	En. ϵ
	17·1	Di. *e*		13·0	En. ϵ		18·4	Mi. θ
	18·5	Rh. θ		13·8	Te. θ		19·5	Di. θ
	19·2	En. θ		14·4	Rh. *e*		21·7	Di. δ
	20·9	Mi. ζ		15·8	Te. δ	Mar. 1	9·0	Te. β
	21·1	Rh. δ		17·0	Di. ζ		11·6	Mi. η
	21·9	Te. θ		18·5	Mi. η		11·9	Te. γ
19	9·5	Di. inf.		18·7	Te. α		13·9	Te. η
	11·2	Di. γ		19·2	Di. β		15·8	Di. *e*
	11·6	En. ζ		20·7	Te. ϵ		17·0	Mi. θ
	13·4	Di. η		20·9	Di. inf.		18·2	En. θ
	14·2	Mi. ϵ		22·4	Di. γ	2	8·2	Di. inf.
	18·0	En. η	25	11·2	Mi. ζ		9·8	Di. γ
	19·6	Mi. ζ		12·4	Te. ζ		10·2	Mi. η
	20·5	Te. ζ		13·0	Rh. ζ		10·4	Rh. η
	22·5	Te. β		13·2	Di. *w*		10·6	Te. α
20	10·4	En. ϵ		14·4	Te. β		10·6	En. ζ
	12·8	Mi. ϵ		15·6	En. θ		12·0	Di. η
	14·5	Di. θ		15·6	Rh. β		12·6	Te. ϵ
	16·7	Di. δ		17·1	Mi. η		15·6	Mi. θ
	18·2	Mi. ζ		17·3	Te. γ		17·0	En. η
	19·2	Te. θ		17·5	Rh. inf.		21·5	Mi. ϵ
	20·0	Di. α		19·3	Te. η	3	9·0	Rh. *w*
	20·5	En. ζ		19·5	Rh. γ		9·2	Te. γ
	21·2	Te. δ		21·9	En. ϵ		9·4	En. ϵ
	22·2	Di. ϵ		22·0	Rh. η		11·2	Te. η
21	9·7	Rh. η	26	8·0	En. ζ		13·2	Di. θ
	10·8	Di. *e*		9·5	Di. ϵ		14·2	Mi. θ
	11·4	Mi. ϵ		9·8	Mi. ζ		15·4	Di. δ
	12·9	En. η		11·1	Te. θ		18·6	Di. α
	16·8	Mi. ζ		13·1	Te. δ		19·5	En. ζ
	17·8	Te. ζ		14·4	En. η		20·1	Mi. ϵ
	19·3	En. ϵ		15·8	Mi. η		20·9	Di. ϵ
	19·8	Te. β		16·0	Te. α	4	9·4	Di. *e*
22	8·3	Rh. *w*		18·0	Te. ϵ		9·8	Te. ϵ
	10·0	Mi. ϵ		20·6	Rh. *w*		10·1	Rh. δ
	11·7	En. η		21·2	Mi. θ		12·0	En. θ
	15·4	Mi. ζ		22·1	Di. *e*		12·0	Rh. sup.
	16·5	Te. θ	27	9·7	Te. ζ		12·8	Mi. θ
	18·5	Te. δ		10·7	Di. ζ		14·0	Rh. α
	19·6	Di. *w*		11·7	Te. β		16·5	Rh. ϵ
23	8·2	Di. θ		12·9	Di. β		18·3	En. ϵ
	8·6	Mi. ϵ		14·4	Mi. η		18·7	Mi. ϵ
	9·4	Rh. δ		14·5	Di. inf.		22·0	Di. ζ
	10·4	Di. δ		14·6	Te. γ	5	8·5	Te. η
	11·4	Rh. sup.		16·2	Di. γ		10·7	En. η
	13·3	Rh. α		16·6	Te. η		11·4	Mi. θ
	13·7	Di. α		16·9	En. ζ		15·1	Rh. *e*
	14·0	Mi. ζ		18·4	Di. η		17·4	Mi. ϵ
	14·3	En. ζ		19·2	Rh. θ		18·2	Di. *w*
	15·1	Te. ζ		19·8	Mi. θ		20·8	En. θ
	15·9	Rh. ϵ		21·8	Rh. δ		22·8	Mi. ζ
	15·9	Di. ϵ	28	8·4	Te. θ	6	9·0	Di. δ
	17·1	Te. β		9·3	En. θ		10·1	Mi. θ
	19·9	Mi. η		10·4	Te. δ		12·3	Di. α
	20·0	Te. γ		13·0	Mi. η		13·3	En. ζ
	20·6	En. η		13·3	Te. α		13·7	Rh. ζ
	22·0	Te. η		15·3	Te. ϵ		14·5	Di. ϵ

1893.	G.M.T. h	
Mar. 6	16·0	Mi. ϵ
	16·3	Rh. β
	18·2	Rh. inf.
	19·6	En. η
	20·1	Rh. γ
	21·4	Mi. ζ
	22·7	Rh. γ
	22·9	Te. ζ
7	8·7	Mi. θ
	12·1	En. ϵ
	14·6	Mi. ϵ
	15·6	Di. ζ
	17·8	Di. β
	19·5	Di. inf.
	20·0	Mi. ζ
	21·1	Di. γ
	21·3	Rh. w
	21·5	Te. θ
	22·2	En. ζ
8	11·9	Di. w
	13·2	Mi. ϵ
	14·6	En. θ
	18·6	Mi. ζ
	19·9	Rh. θ
	20·2	Te. ζ
	20·9	En. ϵ
	22·2	Te. β
	22·4	Rh. δ
9	8·2	Di. ϵ
	11·8	Mi. ϵ
	13·4	En. η
	17·2	Mi. ζ
	18·8	Te. θ
	20·7	Di. e
	20·8	Te. δ
10	9·3	Di. ζ
	10·4	Mi. ϵ
	11·5	Di. β
	13·1	Di. inf.
	14·9	Di. γ
	15·8	Mi. ζ
	15·9	En. ζ
	17·0	Di. η
	17·5	Te. ζ
	19·5	Te. β
	21·7	Mi. η
	22·2	En. η
	22·4	Te. γ
11	8·5	Rh. γ
	9·0	Mi. ϵ
	11·0	Rh. η
	14·4	Mi. ζ
	14·7	En. ϵ
	16·1	Te. θ
	18·1	Te. δ
	18·1	Di. θ
	20·3	Di. δ
	20·3	Mi. η
	21·0	Te. α

1893.	G.M.T. h	
Mar. 12	9·6	Rh. w
	13·0	Mi. ζ
	14·4	Di. e
	14·8	Te. ζ
	16·8	Te. β
	17·2	En. θ
	19·0	Mi. η
	19·7	Te. γ
	21·7	Te. η
13	8·2	Rh. θ
	8·4	Di. γ
	9·7	En. ζ
	10·6	Di. η
	10·8	Rh. δ
	11·7	Mi. ζ
	12·7	Rh. sup.
	13·4	Te. θ
	14·6	Rh. α
	15·4	Te. δ
	16·0	En. η
	17·2	Rh. ϵ
	17·6	Mi. η
	18·3	Te. α
	20·3	Te. ϵ
14	8·4	En. ϵ
	10·3	Mi. ζ
	11·8	Di. θ
	12·0	Te. ζ
	14·0	Di. δ
	14·0	Te. β
	15·8	Rh. e
	16·2	Mi. η
	16·9	Te. γ
	17·3	Di. α
	18·5	En. ζ
	18·9	Te. η
	19·5	Di. ϵ
15	8·0	Di. e
	8·9	Mi. ζ
	10·7	Te. θ
	11·0	En. θ
	12·7	Te. δ
	14·4	Rh. ζ
	14·8	Mi. η
	15·6	Te. α
	16·9	Rh. β
	17·3	En. ϵ
	17·6	Te. ϵ
	18·9	Rh. inf.
	20·2	Mi. θ
	20·6	Di. ζ
	20·8	Rh. γ
	22·8	Di. β
16	9·3	Te. ζ
	9·8	En. η
	11·3	Te. β
	13·4	Mi. η
	14·2	Te. γ
	16·2	Te. η

1893.	G.M.T. h	
Mar. 16	16·9	Di. w
	18·8	Mi. θ
	19·9	En. θ
	22·0	Rh. w
17	8·0	Te. θ
	10·0	Te. δ
	10·9	Di. α
	12·0	Mi. η
	12·3	En. ζ
	12·9	Te. α
	13·1	Di. ϵ
	14·9	Te. ϵ
	17·4	Mi. θ
	18·6	En. η
	20·5	Rh. θ
18	8·6	Te. β
	10·6	Mi. η
	11·1	En. ϵ
	11·5	Te. γ
	13·5	Te. η
	14·2	Di. ζ
	16·0	Mi. θ
	16·5	Di. β
	19·7	Di. γ
	21·2	En. ζ
19	7·3	Te. δ
	9·2	Mi. η
	10·2	Te. α
	10·5	Di. w
	12·2	Tne. ϵ
	13·6	Ei. θ
	14·6	M. θ
	19·9	En. ϵ
	20·5	Mi. ϵ
20	6·8	Di. ϵ
	7·2	Rh. inf.
	7·9	Mi. η
	8·8	Te. γ
	9·1	Rh. γ
	10·8	Te. η
	11·7	Rh. η
	12·4	En. η
	13·3	Mi. θ
	19·2	Mi. ϵ
	19·3	Di. e
21	7·5	Te. α
	7·9	Di. ζ
	9·5	Te. ϵ
	10·1	Di. β
	10·3	Rh. w
	11·9	Mi. θ
	13·4	Di. γ
	14·9	En. ζ
	15·6	Di. η
	17·8	Mi. ϵ
	21·3	En. η
22	8·1	Te. η
	8·9	Rh. θ
	10·5	Mi. θ

1893.	G.M.T. h	
Mar. 22	11·4	Rh. δ
	13·4	Rh. sup.
	13·7	En. ϵ
	15·3	Rh. α
	16·4	Mi. ϵ
	16·7	Di. θ
	17·9	Rh. ϵ
	18·9	Di. δ
	21·8	Mi. ζ
	22·2	Di. α
23	6·8	Te. ϵ
	9·1	Mi. θ
	13·0	Di. e
	15·0	Mi. ϵ
	16·2	En. θ
	16·4	Rh. e
	20·4	Mi. ζ
	22·5	Te. ζ
	22·6	En. ϵ
24	7·0	Di. γ
	7·7	Mi. θ
	8·7	En. ζ
	9·2	Di. η
	13·6	Mi. ϵ
	15·0	En. η
	15·0	Rh. ζ
	17·6	Rh. β
	19·0	Mi. ζ
	19·5	Rh. inf.
	21·1	Te. θ
	21·5	Rh. γ
	21·8	Di. w
25	7·4	En. ϵ
	10·4	Di. θ
	12·2	Mi. ϵ
	12·5	Di. δ
	15·9	Di. α
	17·5	En. ζ
	17·6	Mi. ζ
	18·1	Di. ϵ
	19·8	Te. ζ
	21·8	Te. β
	22·6	Rh. w
26	6·6	Di. e
	10·0	En. θ
	10·8	Mi. ϵ
	16·2	Mi. ζ
	16·3	En. ϵ
	18·4	Te. θ
	19·2	Di. ζ
	20·4	Te. δ
	21·2	Rh. θ
	21·4	Di. β
	22·1	Mi. η
27	6·2	Rh. ϵ
	8·8	En. η
	9·5	Mi. ϵ
	14·9	Mi. ζ

1893.	G.M.T. h	
Mar. 27	15·5	Di. w
	17·1	Te. ζ
	18·9	En. θ
	19·1	Te. β
	20·8	Mi. η
	22·0	Te. γ
28	8·1	Mi. ϵ
	9·5	Di. α
	11·3	En. ζ
	11·7	Di. ϵ
	13·5	Mi. ζ
	15·7	Te. θ
	17·6	En. η
	17·7	Te. δ
	19·4	Mi. η
	20·6	Te. α
29	7·8	Rh. inf.
	9·8	Rh γ
	10·1	En. ϵ
	12·1	Mi. ζ
	12·3	Rh. η
	12·8	Di. ζ
	14·4	Te. ζ
	15·1	Di. β
	16·4	Te. β
	18·0	Mi. η
	18·3	Di. γ
	19·3	Te. γ
	20·2	En. ζ
	20·5	Di. η
	21·3	Te. η
30	9·1	Di. w
	10·7	Mi. ζ
	10·9	Rh. w
	12·6	En. θ
	13·0	Te. θ
	15·0	Te. δ
	16·6	Mi. η
	17·9	Te. α
	19·0	En. ϵ
	19·9	Te. ϵ
	21·7	Di. θ
31	9·3	Mi. ζ
	9·5	Rh. θ
	11·4	En. η
	11·7	Te. ζ
	12·1	Rh. δ
	13·7	Te. β
	14·0	Rh. sup.
	15·2	Mi. η
	15·9	Rh. α
	16·6	Te. γ
	17·9	Di. e
	18·5	Rh. ϵ
	18·6	Te. η
Apr. 1	8·7	Di. β
	10·3	Te. θ
	12·0	Di. γ

1893.	G.M.T. h	
Apr. 1	12·3	Te. δ
	13·8	Mi. η
	13·9	En. ζ
	14·2	Di. η
	15·2	Te. α
	17·1	Rh. e
	17·2	Te. ϵ
2	9·0	Te. ζ
	11·0	Te. β
	12·4	Mi. η
	12·7	En. ϵ
	13·9	Te. γ
	15·3	Di. θ
	15·7	Rh. ζ
	15·9	Te. η
	17·5	Di. δ
	17·8	Mi. θ
	18·2	Rh. β
	20·2	Rh. inf.
	20·8	Di. α
	22·1	Rh. γ
3	7·6	Te. θ
	9·6	Te. δ
	11·1	Mi. η
	11·6	Di. e
	12·5	Te. α
	14·5	Te. ϵ
	15·2	En. θ
	16·5	Mi. θ
	21·6	En. ϵ
4	7·7	En. ζ
	7·9	Di. η
	8·2	Te. β
	9·7	Mi. η
	11·1	Te. γ
	13·1	Te. η
	14·0	En. η
	15·1	Mi. θ
	20·4	Di. w
5	6·8	Rh. ϵ
	6·9	Te. δ
	8·3	Mi. η
	9·0	Di. θ
	9·8	Te. α
	11·2	Di. δ
	11·8	Te. ϵ
	13·7	Mi. θ
	14·5	Di. α
	16·6	En. ζ
	16·7	Di. ϵ
6	8·4	Te. γ
	9·0	En. θ
	10·4	Te. η
	12·3	Mi. θ
	15·3	En. ϵ
	17·8	Di. ζ
	18·2	Mi. ϵ
	20·0	Di. β

1893.	G.M.T. h		1893.	G.M.T. h.		1893.	G.M.T. h	
Apr. 7	6·6	Rh. β	Apr. 12	20·1	Te. δ	Apr. 18	12·7	Di. w
	7·1	Te. α	13	8·5	Mi. ϵ		12·9	Mi. η
	7·8	En. η		11·7	En. ϵ		13·4	Rh. δ
	8·5	Rh. inf.		13·9	Mi. ζ		14·8	Te. α
	9·1	Te. ϵ		16·9	Di. θ		15·3	Rh. sup.
	10·4	Rh. γ		16·1	Di. δ		16·8	Te. ϵ
	10·9	Mi. θ		16·7	Te. ζ		16·9	En. θ
	13·0	Rh. η		18·7	Te. β		17·3	Rh. α
	14·1	Di. w		19·4	Di. α		18·3	Mi. θ
	16·8	Mi. ϵ		19·8	Mi. η		19·8	Rh. ϵ
	17·9	En. θ		21·6	Te. γ	19	8·6	Te. ζ
8	7·7	Te. η		21·6	Di. ϵ		8·9	Di. ϵ
	8·1	Di. α	14	7·5	Rh. ϵ		9·3	En. ζ
	9·5	Mi. θ		10·2	Di. e		10·6	Te. β
	10·3	En. ζ		12·5	Mi. ζ		11·5	Mi. η
	10·3	Di. ϵ		14·3	En. θ		13·5	Te. γ
	11·6	Rh. w		15·3	Te. θ		15·5	Te. η
	15·4	Mi. ϵ		17·3	Te. δ		15·7	En. η
	16·7	En. η		18·4	Mi. η		16·9	Mi. θ
9	6·4	Te. ϵ		20·2	Te. α		18·4	Rh. e
	8·1	Mi. θ		20·6	En. ϵ	20	9·2	Te. δ
	9·1	En. ϵ	15	6·1	Rh. e		10·1	Di. ζ
	10·2	Rh. θ		6·5	Di. η		10·1	Mi. η
	11·5	Di. ζ		6·7	En. ζ		12·1	Te. α
	12·7	Rh. δ		11·1	Mi. ζ		12·3	Di. β
	13·7	Di. β		13·0	En. η		14·1	Te. ϵ
	14·0	Mi. e		14·0	Te. ζ		15·5	Mi. θ
	14·7	Rh. sup.		16·0	Te. β		15·6	Di. γ
	16·6	Rh. α		17·0	Mi. η		17·0	Rh. ζ
	16·9	Di. γ		18·9	Te. γ		17·8	Di. η
	19·2	Di. η		19·0	Di. w		18·2	En. ζ
	19·2	Rh. ϵ	16	7·2	Rh. β		19·6	Rh. β
	19·2	En. ζ		7·6	Di. θ	21	7·9	Te. β
	19·4	Mi. ζ		9·2	Rh. inf.		8·7	Mi. η
10	7·7	Di. w		9·7	Mi. ζ		10·7	En. θ
	11·6	En. θ		9·8	Di. δ		10·8	Te. γ
	12·7	Mi. ϵ		11·1	Rh. γ		12·8	Te. η
	17·7	Rh. e		12·6	Te. θ		14·1	Mi. θ
	18·0	En. ϵ		13·1	Di. α		17·0	En. ϵ
	18·1	Mi. ζ		13·7	Rh. η		18·9	Di. θ
	20·3	Di. θ		14·6	Te. δ	22	9·4	Te. α
	20·8	Te. θ		15·3	Di. ϵ		9·4	En. η
11	10·4	En. η		15·6	En. ζ		11·4	Te. ϵ
	11·3	Mi. ϵ		15·7	Mi. η		12·7	Mi. θ
	16·3	Rh. ζ		17·5	Te. α		15·2	Di. e
	16·5	Di. e		19·5	Te. ϵ		18·6	Mi. ϵ
	16·7	Mi. ζ	17	8·0	En. θ	23	8·1	Te. γ
	18·9	Rh. β		8·4	Mi. ζ		8·2	Rh. ϵ
	19·4	Te. ζ		11·3	Te. ζ		9·2	Di. γ
	20·5	En. θ		12·2	Rh. w		10·1	Te. η
	20·8	Rh. inf.		13·3	Te. β		11·4	Mi. θ
	21·4	Te. β		14·3	Mi. η		11·4	Di. η
12	7·3	Di. β		14·4	En. ϵ		12·0	En. ζ
	9·9	Mi. ϵ		16·2	Te. γ		17·3	Mi. ϵ
	10·6	Di. γ		16·4	Di. ζ		18·3	En. η
	12·8	Di. η		18·2	Te. η	24	6·8	Rh. e
	12·9	En. ζ		18·6	Di. β		8·7	Te. ϵ
	15·3	Mi. ζ	18	9·9	Te. θ		10·0	Mi. θ
	18·1	Te. θ		10·8	Rh. θ		10·8	En. ϵ
	19·3	En. η		11·9	Te. δ		12·6	Di. θ

G.M.T. 1893.	h		G.M.T. 1893.	h		G.M.T. 1893.	h	
Apr. 24	14·8	Di. δ	May 1	17·5	Mi. η	May 6	18·7	Rh. α
	15·9	Mi. ϵ		19·9	Te. α		18·7	En. ϵ
	18·1	Di. α	2	8·9	Rh. ϵ	7	8·9	Te. δ
25	7·4	Te. η		9·7	En. θ		9·2	Mi. η
	7·9	Rh. β		10·2	Mi. ζ		11·1	En. η
	8·6	Mi. θ		13·7	Te. ζ		11·8	Te. α
	8·8	Di. e		15·7	Te. β		13·8	Te. ϵ
	9·8	Rh. inf.		16·0	En. ϵ		14·6	Mi. θ
	11·8	Rh. γ		16·1	Mi. η		16·3	Di. w
	13·3	En. θ		17·6	Di. θ		19·8	Rh. e
	14·3	Rh. η		18·6	Te. γ	8	7·1	Di. δ
	14·5	Mi. ϵ		19·8	Di. δ		7·6	Te. β
26	12·1	En. η	3	7·5	Rh. e		7·8	Mi. η
	12·9	Rh. w		8·5	En. η		10·4	Di. α
	13·1	Mi. ϵ		8·8	Mi. ζ		10·5	Te. γ
	17·7	Di. w		12·3	Te. θ		12·5	Te. η
	18·5	Mi. ζ		13·8	Di. e		12·6	Di. ϵ
27	8·4	Di. δ		14·3	Te. δ		13·2	Mi. θ
	11·5	Rh. θ		14·7	Mi. η		13·7	En. ζ
	11·7	Di. α		17·2	Te. α		18·4	Rh. ζ
	11·7	Mi. ϵ		18·6	En. θ	9	9·1	Te. α
	13·9	Di. ϵ		19·2	Te. ϵ		11·1	Te. ϵ
	14·1	Rh. δ	4	7·9	Di. γ		11·8	Mi. θ
	14·6	En. ζ		8·6	Rh. β		12·4	En. ϵ
	16·0	Rh. sup.		10·1	Di. η		13·7	Di. ζ
	17·1	Mi. ζ		10·5	Rh. inf.		15·9	Di. β
	17·9	Rh. α		11·0	Te. ζ		17·7	Mi. ϵ
28	10·3	Mi. ϵ		11·0	En. ζ		19·2	Di. γ
	13·4	En. ϵ		12·5	Rh. γ	10	7·7	Te. γ
	15·1	Di. ζ		13·0	Te. β		9·7	Te. η
	15·7	Mi. ζ		13·3	Mi. η		10·0	Di. w
	17·3	Di. β		15·0	Rh. η		10·4	Mi. θ
	19·1	Te. ζ		15·9	Te. γ		15·0	En. θ
	19·1	Rh. e		17·4	En. η		16·3	Mi. ϵ
29	9·0	Mi. ϵ		17·9	Te. η	11	6·3	Di. ϵ
	11·3	Di. w	5	9·6	Te. θ		6·4	Te. α
	14·4	Mi. ζ		9·8	En. ϵ		7·0	Rh. α
	15·9	En. θ		11·2	Di. θ		7·4	En. ζ
	17·7	Rh. ζ		11·6	Te. δ		8·4	Te. ϵ
	17·7	Te. θ		12·0	Mi. η		9·1	Mi. θ
	19·7	Te. δ		13·4	Di. δ		9·6	Rh. ϵ
30	7·6	Mi. ϵ		13·6	Rh. w		13·8	En. η
	7·6	Di. ϵ		14·5	Te. α		15·0	Mi. ϵ
	8·4	En. ζ		16·5	Te. ϵ		18·2	Di. e
	13·0	Mi. ζ		16·7	Di. α	12	7·1	Te. η
	14·7	En. η		17·4	Mi. θ		7·4	Di. ζ
	16·4	Te. ζ		18·9	Di. ϵ		7·7	Mi. θ
	18·4	Te. β	6	7·5	Di. e		8·2	Rh. e
	18·9	Mi. η		8·3	Te. ζ		9·6	Di. β
May 1	7·2	En. ϵ		10·3	Te. β		12·9	Di. γ
	8·7	Di. ζ		10·6	Mi. η		13·6	Mi. ϵ
	10·9	Di. β		12·2	Rh. θ		15·1	Di. η
	11·6	Mi. ζ		12·3	En. θ		16·3	En. ζ
	14·2	Di. γ		13·2	Te. γ	13	6·8	Rh. ϵ
	15·0	Te. θ		14·8	Rh. δ		8·7	En. θ
	16·4	Di. η		15·2	Te. η		9·4	Rh. β
	17·0	Te. δ		16·0	Mi. θ		11·3	Rh. inf.
	17·3	En. ζ		16·7	Rh. sup.		12·2	Mi. ϵ

1893.	G.M.T. h		1893.	G.M.T. h		1893.	G.M.T. h	
May 13	13·2	Rh. γ	May 20	14·6	Di. β	May 27	9·5	Te. η
	15·1	En. ϵ		16·9	Te. α		9·6	Mi. θ
	15·8	Rh. η		17·9	Di. γ		10·8	Di. δ
	16·2	Di. θ	21	8·7	Di. w		14·1	Di. α
	17·4	Mi. ζ		9·0	Rh. e		15·5	Mi. ϵ
	18·4	Di. δ		10·7	Te. ζ		16·3	Di. ϵ
14	7·5	En. η		12·4	Mi. η	28	8·1	Te. ϵ
	10·8	Mi. ϵ		12·7	Te. β		8·2	Mi. θ
	12·5	Rh. w		14·0	En. θ		10·5	En. θ
	16·2	Mi. ζ		17·6	Te. γ		14·1	Mi. ϵ
	17·6	En. θ	22	7·6	Rh. ζ		16·8	En. ϵ
	20·1	Te. θ		9·3	Te. θ		17·4	Di. ζ
15	8·8	Di. η		10·1	Rh. β	29	8·6	Rh. α
	9·4	Mi. ϵ		11·1	Mi. η		9·2	En. η
	10·1	En. ζ		11·3	Te. δ		11·2	Rh. ϵ
	13·0	Rh. θ		12·1	Rh. inf.		12·7	Mi. ϵ
	14·8	Mi. ζ		12·8	En. η		13·7	Di. w
	15·5	Rh. δ		14·0	Rh. γ	30	7·8	Di. α
	16·4	En. η		14·2	Te. α		9·8	Rh. e
	17·5	Rh. sup.		16·2	Te. ϵ		10·0	Di. ϵ
	18·8	Te. ζ		16·5	Mi. θ		11·3	Mi. ϵ
16	8·1	Mi. ϵ		16·6	Rh. η		11·8	En. ζ
	8·9	En. ϵ		17·5	Di. ϵ		16·7	Mi. ζ
	9·9	Di. θ	23	8·0	Te. ζ		18·1	En. η
	12·1	Di. δ		8·3	Di. β	31	8·4	Rh. ζ
	13·5	Mi. ζ		9·7	Mi. η		9·9	Mi. ϵ
	15·4	Di. α		10·0	Te. β		10·6	En. ϵ
	17·4	Te. θ		11·6	Di. γ		10·9	Rh. β
	17·6	Di. ϵ		13·8	Di. η		11·1	Di. ζ
17	11·4	En. θ		14·9	Te. γ		12·9	Rh. inf.
	12·1	Mi. ζ		15·1	Mi. θ		13·3	Di. β
	16·1	Te. ζ		15·2	Rh. w		14·8	Rh. γ
	17·7	En. ϵ		15·4	En. ζ		15·3	Mi. ζ
	18·0	Mi. η		16·9	Te. η		16·6	Di. γ
	18·1	Ti. β	24	8·6	Te. δ		17·4	Rh. η
	18·7	Di. ζ		11·5	Te. α		18·8	Di. η
	19·2	Rh. ζ		13·5	Te. ϵ	June 1	7·4	Di. w
18	10·2	En. η		13·7	Mi. θ		8·6	Mi. ϵ
	10·7	Mi. ζ		13·8	Rh. θ		13·1	En. θ
	14·7	Te. θ		14·2	En. ϵ		14·0	Mi. ζ
	15·0	Di w		14·9	Di. θ		16·0	Rh. w
	16·6	Mi. η		16·3	Rh. δ		18·5	Te. ζ
	16·7	Te. δ		17·1	Di. δ	2	11·9	En. η
19	9·1	Di. α		18·3	Rh. sup.		12·6	Mi. ζ
	9·3	Mi. ζ	25	7·3	Te. β		14·6	Rh. θ
	11·3	Di. ϵ		10·2	Te. γ		16·2	Di. e
	12·7	En. ζ		11·2	Di. ϵ		17·1	Rh. δ
	13·4	Te. ζ		12·2	Te. η		17·2	Te. θ
	15·2	Mi. η		12·3	Mi. θ	3	10·3	Di. γ
	15·4	Te. β		16·7	En. θ		11·2	Mi. ζ
	18·3	Te. γ	26	7·5	Di. η		12·5	Di. η
20	7·8	Rh. α		8·8	Te. α		14·5	En. ζ
	7·9	Mi. ζ		9·1	En. ζ		15·8	Te. ζ
	10·4	Rh. ϵ		10·8	Te. ϵ		17·1	Mi. η
	11·5	En. ϵ		10·9	Mi. θ		17·8	Te. β
	12·0	Te. θ		15·5	En. η	4	9·8	Mi. ζ
	12·4	Di. ζ	27	7·5	Te. γ		13·2	En. ϵ
	13·8	Mi. η		7·9	En. ϵ		13·7	Di. θ
	14·0	Te. δ		8·6	Di. θ		14·5	Te. θ

G.M.T. 1893.	h		G.M.T. 1893.	h		G.M.T. 1893.	h	
June 4	15·7	Mi. η	June 10	16·8	Rh. w	June 19	15·0	En. ϵ
	15·9	Di. δ	11	9·7	En. ϵ		17·0	Te. θ
	16·5	Te. δ		9·9	Di. ζ		17·2	Di. β
5	8·4	Mi. ζ		10·0	Te. γ	20	7·5	En. η
	9·9	Di. e		11·5	Mi. θ		10·4	Mi. ζ
	13·1	Te. ζ		12·0	Te. η		11·3	Di. w
	14·3	Mi. η		12·1	Di. β		15·6	Te. ζ
	15·1	Te. β		15·4	Di. γ		16·3	Mi. η
	15·8	En. θ		15·4	Rh. θ		16·3	Rh. θ
6	8·2	En ζ		17·4	Mi. ϵ	21	7·5	Di. ϵ
	11·8	Te. θ		17·6	Di. η		9·0	Mi. ζ
	13·0	Mi. η		18·0	Rh. δ		10·0	En. ζ
	13·8	Te. δ	12	6·2	Di. w		14·3	Te. θ
	14·6	En. η		8·6	Te. α		14·9	Mi. η
	16·7	Te. α		10·1	Mi. θ		16·3	Te. δ
7	7·4	Di. θ		10·6	Te. ϵ		16·4	En. η
	7·5	Rh. sup.		12·2	En. θ	22	8·7	Di. ζ
	9·4	Rh. α		16·0	Mi. ϵ		8·8	En. ϵ
	9·6	Di. δ	13	7·3	Te. γ		10·9	Di. β
	10·4	Te. ζ		8·7	Mi. θ		12·9	Te. ζ
	11·6	Mi. η		9·3	Te. η		13·5	Mi. η
	12·0	Rh. ϵ		11·0	En. η		14·2	Di. γ
	12·4	Te. β		14·6	Mi. ϵ		14·9	Te. β
	12·8	Di. α		15·0	Di. e		16·4	Di. η
	15·1	Di. ϵ	14	7·9	Te. α	23	7·5	Rh. η
	15·3	Te. γ		9·1	Di. γ		11·4	En. θ
	17·0	Mi. θ		9·9	Te. ϵ		11·6	Te. θ
	17·1	En. ζ		11·3	Di. η		12·1	Mi. η
	17·3	Te. η		13·2	Mi. ϵ		13·6	Te. δ
8	9·1	Te. θ		13·6	En. ζ		16·5	Te. α
	9·6	En. θ	15	11·9	Mi. ϵ	24	6·2	Rh. w
	10·2	Mi. η		12·4	En. ϵ		10·1	En. η
	10·6	Rh. e		12·4	Di. θ		10·3	Te. ζ
	11·1	Te. δ		14·6	Di. δ		10·8	Mi. η
	14·0	Te. α	16	8·4	Rh. sup.		12·3	Te. β
	15·6	Mi. θ		8·7	Di. e		13·8	Di. e
	15·9	En. ϵ		10·3	Rh. α		15·2	Te. γ
	16·0	Te. ϵ		10·5	Mi. ϵ	25	7·3	Rh. δ
	16·2	Di. ζ		12·9	Rh. ϵ		7·9	Di. γ
9	7·7	Te. ζ		14·9	En. θ		8·9	Te. θ
	8·4	En. η	17	7·3	En. ζ		9·3	Rh. sup.
	8·8	Mi. η		9·1	Mi. ϵ		10·1	Di. η
	9·2	Rh. ζ		11·5	Rh. e		10·9	Te. δ
	9·7	Te. β		13·7	En. η		11·2	Rh. α
	11·8	Rh. β		14·5	Mi. ζ		13·7	Rh. ϵ
	12·5	Di. w		17·6	Di. w		13·8	Te. α
	12·7	Te. γ	18	8·3	Di. δ		15·8	Te. ϵ
	13·7	Rh. inf.		10·1	Rh. ζ	26	7·6	Te. ζ
	14·2	Mi. θ		11·6	Di. α		9·6	Te. β
	14·7	Te. η		12·1	Mi. ζ		11·2	Di. θ
	15·6	Rh. γ		12·7	Rh. β		12·4	Rh. e
	18·2	Rh. η		13·8	Di. ϵ		12·5	Te. γ
10	8·4	Te. δ		14·6	Rh. inf.		13·5	Di. δ
	8·7	Di. ϵ		16·2	En. ζ		14·5	Te. η
	10·9	En. ζ		16·5	Rh. γ	27	7·5	Di. e
	11·3	Te. α	19	8·7	En. θ		8·2	Te. δ
	12·8	Mi. θ		11·7	Mi. ζ		11·0	Rh. ζ
	13·3	Te. ϵ		15·0	Di. ζ		11·1	Te. α

G.M.T.			G.M.T.			G.M.T.		
1893.	h		1893.	h		1893.	h	
June 27	13·1	Te. ϵ	June 29	7·2	Di. δ	June 30	7·1	Te. γ
	13·6	Rh. β		8·5	Te. α		9·1	Te. η
	15·5	Rh. inf.		10·4	Di. α		13·8	Di. ζ
28	9·8	Te. γ		10 5	Te. ϵ		16·0	Di. β
	11·8	Te. η		12·6	Di. ϵ	July 4	10·2	Rh. sup.
	16·4	Di. w						

Colonel Cooper's Observatory,
Markree, Collooney, Ireland.

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Printed by Spottiswoode & Co., New-street Square, London; and Published at the Apartments of the Society, February 1893.

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